Empirical testing of Balassa-Samuelson hypothesis with German and UK data

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Empirical testing of Balassa-Samuelson hypothesis with German and UK data

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Abstracт

There are a lot of studies that test Ballasa –Samuelson hypothesis also known as Harrod-BalassaSamuelson effect directly via the effect of productivity, one possible explanation is that PER Capita GDP is not good explanation for productivity (.i.e. Labor productivity) differences; an increase (decrease) in relative efficiency of the distribution sector with respect to foreign countries induces depreciation (appreciation) of the exchange rate. After we obtained the number of co-integrated vectors we continue further to see whether the CV tells us something about the long run relationship into the model, likelihood ratio test of exactly identified restrictions test confirms that constant is insignificant variable therefore we can confirm that there is long-run relationship in which the changes in Exchange rate are positively correlated with the changes of ratio of German Consumer Price Index (CPI) to the UK Retail Price Index (RPI). In order to test for relative PPP to support the theoretical relationship between the variables, restrictions are put on the PPP knowing that PPP and that downward movement in the series indicates increase of UK price level relative to German price level. In each EC model there is an EC mechanism and coefficient on the co integrating vector measures the rate per period at which one of the endogenous variables adjusts. In the first equation the error correction mechanism is highly significant and negative. If the system is out of equilibrium, alteration in the change of the exchange rates will be downward (everything else ceteris paribus) compensating around 68% of the disequilibrium per year. In the second equation error correction mechanism is also highly significant but positive meaning that if the system is in disequilibrium changes of change in the ratio of German CPI relative to UK Retail Price index will rise offsetting 15% of the disequilibrium per year until the equilibrium rate of exchange rate will be achieved. Model implies German Labor productivity to UK Labor productivity ratio doesn’t have significant influence on explaining on relative change on prices not even on theexchange rate contrary to Pugh, Beachil study

Key words: Purchasing power parity, Exchange rate, co integration, error correction model, productivity, Consumer Price Index, Retail Price Index,

1. Unit Root test ADF-Perron procedure conducted on STDMER70 , PPP70, PRDRATIO

There are a lot of studies that test Ballasa –Samuelson [2] hypothesis directly via the effect of productivity [3] .i.e. Labour productivity [4].Since in the paper it is not tested for unit root conditional upon structural breaks here is applied modified ADF/Perron test [5]

The H_0: time series has a unit root with possibly non-zero drift against the alternative that the process is trend stationary

$$y_t = \mu_1 + y_{t-1} + dD(TB) + (\mu_2 - \mu_1)DU_T + e_t$$

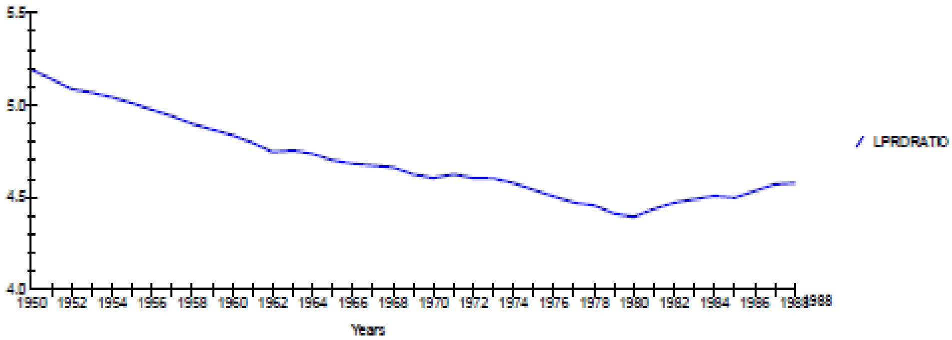
$$D(TB)_t = 1 \ \ if \ \ t = T_B + 1, 0 \quad otherwise$$

$$DU_t = 1 \qquad if \quad t > T_B \quad \text{0 otherwise}$$

$$\text{And A (L)} e_T = B(L)v_t \ \ v_t \sim (0, \sigma^2)$$

Plot of data

Plot of $\frac{UK}{German}$ productivity ratio supports the idea of structural break in 1980 with movement



[1] See Appendix 1 Variable definition

[2] Also known as Harrod-Balassa-Samuelson effect (Kravis and Lipsey 1983)

[3] One possible explanation is that PER Capita GDP is not good explanation for productivity differences ; an increase(decrease) in relative efficiency of the distribution sector with respect to foreign countries induces depreciation (appreciation) of the Exchange Rate.

[4] Beachill Bob; Pugh Geoffrey (1998) Monetary cooperation in Europe and the problem of differential productivity growth. International Review of Applied Economics , Vol.12, No 3 (Sept.1998) pp.455-57

[5] Pierre Perron(1989) The Great crash , the oil stock and the unit root hypothesis

from downwards to upwards in 1980[6].Plot of the first difference of the log form [7].did not revel conclusion about the serial movement.

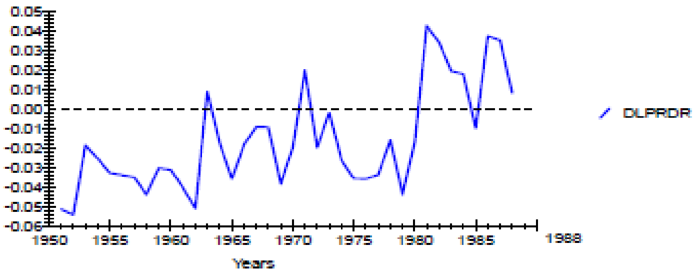


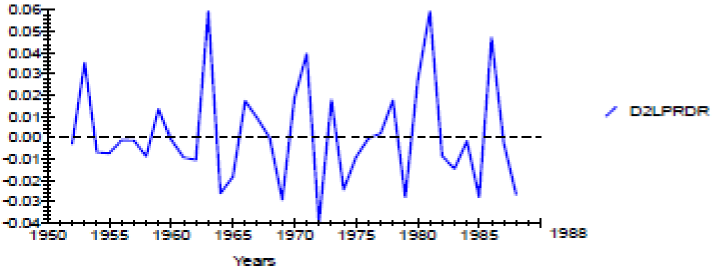
Table 1 List of the data

	LPRDR	DLPRDR
1978	4.4555	-0.01613
1979	4.4116	-0.04392
1980	4.3944	-0.01714
1981	4.4368	0.042302
1982	4.4705	0.033744
1983	4.4898	0.019264

List of the data shows switch of the data from deceasing to increasing trend and for DLPRDR switch from negative to positive values. Graphically it can be shown that PRDRATIO is I(2) variable .But the previous plot shows that PPP70 van be I(2) variable also.

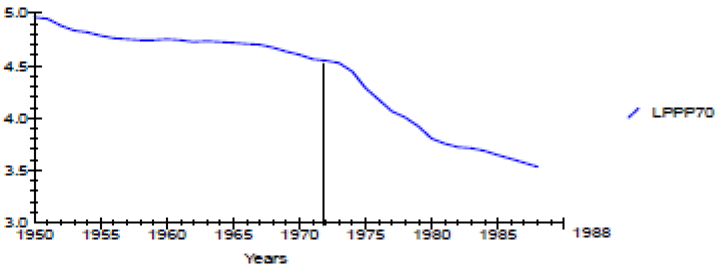
[6] 1979-1980 marked a change in UK supply side policy accordingly it is taken 1981 as the year after the structural break which is confirmed by the data plot

[7] Log form it is taken as more appropriate even though all data are plotted see appendix 1



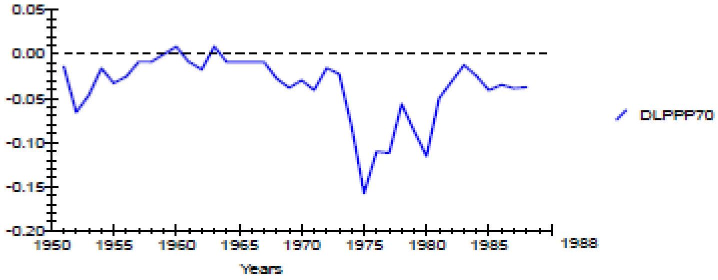
Plotting the data for PPP70 purchasing power parity variable 2ND difference of the log of PPP70 is I(0)

(8)

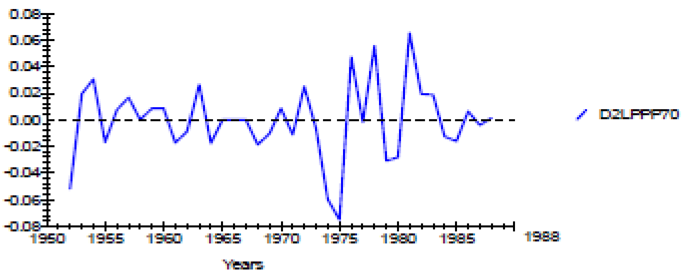


Plot of the PPP70 variable shows existence of the structural break in 1974

[8] Which theoretically as it is known marks the breakdown of Bretton woods system of fixed Exchange Rates



Plot of the first difference of the log level of PPP70 does not reveal conclusion about the serial movement I(1)



Plot shows that D2LPPP70 is stationary I(0)

Table 2 List of the data

	LPPP70	DLPPP70
1971	4.5643	-0.04082
1972	4.5486	-0.01575
1973	4.5261	-0.02247
1974	4.4438	-0.082300
1975	4.2863	-0.15749
1976	4.1759	-0.11042

After the break down of Bretton Woods there is continuation in decreasing trend of the variable and there is a shift in the first difference form negative to positive

(9)

a. ADF / Perron test unit root test for the STDMER70 variable
$DER70 = Int + \theta D_{ut} + \beta Tim + \gamma DT_{t} + \delta DTB_t + \widehat{\beta}_1 y_{t-1} + \sum_{i=k}^{k} \hat{c}\Delta y_{t-1} + \hat{e}_t$ [10]
$DLER70 = Int + \theta D_{ut} + \beta TIM + \gamma DT_T + \delta DTB_t + \widehat{\beta}_1 Ly_{t-1} + \sum_{i=k}^{k} \hat{c}\Delta y_{t-1} + \hat{e}_t$ [11]
$D2LER70 = Int + \theta D_{ut} + \beta TIM + \gamma DT_t + \delta DTB_T + \widehat{\beta}_1 Ly_{t-1} + \sum_{i=k}^{k} \hat{c}\Delta y_{t-1} + \hat{e}_t$ [12]
$D2ER70 = Int + \theta D_{ut} + \beta TIM + \gamma DT_t + \delta DTB_t + \widehat{\beta}_{1yt-1} + \sum_{i=k}^{k} \hat{c}\Delta y_{t-1} + \hat{e}_t$ [13]

Model C defined by Perron(1989)(14) is fully specified and it takes all the various changes in time series into account. All three variables are being tested

DTBER70 dummy variable for the immediate change after the break in it models a onetime change in the intercept and is =1; DV=1 if $t = t_b + 1$; otherwise 0;

DUER70- dummy variable DUER70=1; if $t > TB$; otherwise 0; changes in the drift parameter in every period after the break;

DTER70- dummy variable if t>TB ; otherwise 0 allows for a changes in the slope of the trend function

TIM- deterministic time trend

TB – time break from theoretical knowledge and by plotting the data we suspect that it is 1967 sterling substantial devaluation (see plot of the log level of the STDMER70) variable .1968 is equal to TB+1

[9] Variables definitions see Appendix 1 Section A

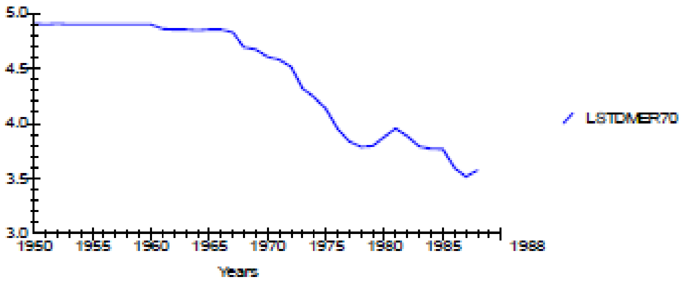
[10] This model is tested in log terms as it is in levels see Appendix 2 Section B

[11] This is a log form of the model first difference in a logs DLER70 and log of the dependent variable level form. See Appendix 2 part 2 2 a

[12] See Appendix 3a ADF/Perron test fo the log levels of the variables of interest

[13] See Appendix 2 section 2 part 1a variables ADF Perron test for 1st differences of the variables of interest this all 4 equations in the remaining text will be reffered as equation 1,2,3,4.

[14] H0:UNIT ROOT conditional on drift deterministic trend and 3 types of structural break



Plot of the data of the log level of STDMER70 variable confirms existence of structural break in 1967

Equation 1

1. For the equation 1 t-statistics on the lagged value of the series is -1.65 time of the break relative to total sample size $\lambda = \frac{19}{39} = 0{,}48 \sim 48\%$

Sample size= 39 observations 5% critical value between -4.22($\lambda = 40\%$) and –4.24($\lambda = 50\%$)

H_0: unit root cannot be rejected

We cannot reject the null hypothesis

No serial correlation p-value =(.113) **AT 7 LAGS** functional form is well specified

Equation 2 (15)

2. For the equation 2 t-statistics on the lagged value of the series is -2.46 time of the break relative to the sample size is $\lambda = 48\%$

Sample size=39 observations 5% critical value between $|4.22|$ and $|4.24|$ and null hypothesis of unit root existence cannot be rejected and hypothesis of no serial correlation p-value (0.634) F-pvalue (0.696) **AT 3 LAGS** functional form well specified

[15] See Appendix 2 section 2a critical values for λ can be found in Perron(1989)

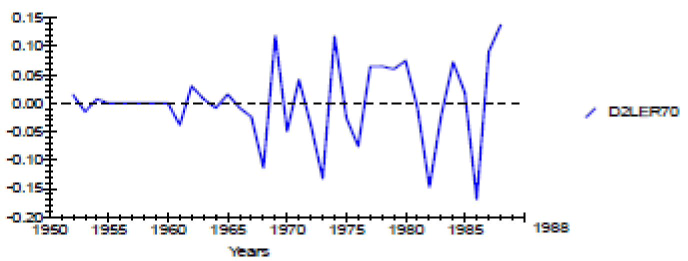
Equation 3 [16]

3. For the equation 3 t-stat on the lagged value of time series is -2.72 time of the break relative to the sample size $\lambda = 48\%$ Sample size is 39 observations we accept the form with no lags and DW statistics which is valid if on the right hand side of the equation there are no lags shows no serial correlation (2.0796) and type 1 error of making mistake if we reject the null of no serial correlations is 48% 0 lags of the dependent variable

Equation 4[17]

4. For the equation 4 t stat on the lagged value of the time series -1.73 Probability of type 1 error of making mistake if we reject the null of no serial correlation 95% the null hypothesis of no unit root cannot be rejected WITH 1 LAG of the dependent variable

Having in mind possible multicollinearity we accept equation with no lags of the dependent variable on RHS (Equation 3) for further analysis



1st difference of the log level of UK sterling exchange rate/DM is I(0)

[16] See Appendix 3 Section 3 a
[17] See Appendix 2 section 1a

b. DF/ADF / Perron test unit root test for the PPP70 variable
For this regression were created the following terms DTBPPP70 time of the break dummy variable =1 if $t = T_b + 1$ immediately after the break 1974 (see plot of the data above) DUPPP70 DV=1 for all periods immediately after the break (1974 1988) DTPPP70=TIME TREND if t>TB ; otherwise 0;

Equation1 [18] $DPP70 = Int + \theta DPPP70_{ut} + \beta Tim + \gamma DTPPP70_t + \delta DTBPPP70_t + \hat{\beta}_1 y_{t-1} + \sum_{i=k}^{k} \hat{c}\Delta y_{t-1} + \hat{e}_t$
1 LAG of the dependent variable $\lambda = \frac{26}{39} = 0{,}66 \sim 66\%$ for 5 % level of significance critical value is -4.24(60%) and -4.18(70%) t-stat on the lagged time series is -4.19 it is between the interval and the null hypothesis that the unit root cannot be rejected is accepted i.e. insufficient evidence to reject at conventional levels of significance
Equation 2 [19] $DLPPP70 = Int + \theta DPPP70_{ut} + \beta TIM + \gamma DTPPP70_T + \delta DTBPPP70_t + \hat{\beta}_1 Ly_{t-1} + \sum_{i=k}^{k} \hat{c}\Delta y_{t-1} + \hat{e}_t$
1 lag of the dependent variable t-stat on the lagged time series is -3.78 the null hypothesis of unit root cannot be rejected and the null hypothesis of no serial correlation cannot be rejected at conventional levels of significance i.e. probability of committing type 1 error is 72%.
Equation 3 [20] $D2LPPP70 = Int + \theta DPPP70_{ut} + \beta TIM + \gamma DTPPP70_t + \delta DTBPPP70_T + \hat{\beta}_1 Ly_{t-1} + \sum_{i=k}^{k} \hat{c}\Delta y_{t-1} + \hat{e}_t$
O lags of the dependent variable the t-stats of the lagged time series in the equation is -2.93 and the null hypothesis at 5% for values of λ =-4.24(60%) and -4.18(70%) cannot be rejected and null hypothesis of no serial correlation cannot be rejected at 5% conventional level of significance by large sample test Langrange which follows χ^2 distribution and 1%,5%, 10% , level of significance by small sample technique F test p-value 10,6%
Equation 4 [21] $D2PPP70 = Int + \theta DPPP70_{ut} + \beta TIM + \gamma DTPPP70_t + \delta DTBPPP70_t + \widehat{\beta}_{1_{yt-1}} + \sum_{i=k}^{k} \hat{c}\Delta y_{t-1} + \hat{e}_t$
1 lag of the dependent variable the t-stats of the lagged time series in the equation is -6.24 and there is sufficient evidence to reject null of unit root DW is a general diagnostic test [22] and its value 1.9 shows no serial correlation and functional form is well specified.

[18] See Appendix 2 Section 1 b
[19] See Apendix 2 Section2 part 2b
[20] See Appendix 2 Section 3 part 3b
[21] See Appendix 2 Section 2 PART 1b
[22] DW=$2(1-\hat{\rho})$

c. ADF / Perron test unit root test for the PRDRATIO variable

For these 4 models we created following Perron's terms DTBPRDR =1; IF T=TB +1 otherwise 0; from the other plot above is 1980 and year after the break is 1981; DUPRDR=1 IF t>TB ; otherwise 0; DTPRDR=T if t>TB ; otherwise 0; which allows for a sudden change in the slope of the trend

Equation 1 (23) $DPRDR = Int + \theta DPRDR_{ut} + \beta Tim + \gamma DPRDR_{t} + \delta DTBPRDR_t + \hat{\beta}_1 y_{t-1} + \sum_{i=k}^{k} \hat{c}\Delta y_{t-1} + \hat{e}_t$
O lags of the dependent variable $\lambda = \frac{32}{39} = 82\%$ t-stat on the lagged time series is -2.41 while values for λ from the tables are -4.04 (80%) and -4.10 (90%) and the null of existence of unit root cannot be rejected
Equation 2 (24) $DLPRDR = Int + \theta DPRDR_{ut} + \beta TIM + \gamma DTPPRDR_T + \delta DTBPRDR_t + \hat{\beta}_1 Ly_{t-1} + \sum_{i=k}^{k} \hat{c}\Delta y_{t-1} + \hat{e}_t$
0 lags of the dependent variable t-stat of the lagged value of time series -2.44 and the null hypothesis of unit root cannot be rejected probability of type 1 error when rejecting the null of no serial correlation is 72%
Equation 3 (25) $D2LPRDR = Int + \theta DPRDR_{ut} + \beta TIM + \gamma DTPRDR_t + \delta DTBPRDR_T + \hat{\beta}_1 Ly_{t-1} + \sum_{i=k}^{k} \hat{c}\Delta y_{t-1} + \hat{e}_t$
3 lags of the dependent variable t-stat of the lagged value of time series is -3.01 and the null hypothesis of not rejecting the unit root there is sufficient evidence to accept at te conventional levels of significance and no serial correlation cannot be rejected (26)
Equation 4 (27) $D2PRDR = Int + \theta DPRDR_{ut} + \beta TIM + \gamma DTPRDR_t + \delta DTBPRDR_t + \hat{\beta_1}_{yt-1} + \sum_{i=k}^{k} \hat{c}\Delta y_{t-1} + \hat{e}_t$
1 LAG of the dependent variable t-stat of the lagged value of time series is -2.41 and the null hypothesis of no unit root cannot be rejected probability of type 1 error when rejecting the null of no serial correlation 12.3%

[23] See Appendix 2 Section 1 b
[24] See Appendix 2 section 2c
[25] See Appendix 2 section 3 part 3c
[26] Probability of type 1 error is 14.7%
[27] See Appendix 2 Section3 part 3

For the purpose of the cointegration analysis 3 equations are chosen according to the diagnostics and number of lags we choose the following equations
1. $D2LER70 = Int + \theta D_{ut} + \beta TIM + \gamma DTER70_t + \delta DTBER70_T + \hat{\beta}_1 Ly_{t-1} + \hat{e}_t$
2. $D2LPPP70 = Int + \theta DPPP70_{ut} + \beta TIM + \gamma DTPPP70_t + \delta DTBPPP70_T + \hat{\beta}_1 Ly_{t-1} + \hat{e}_t$
3. $DLPRDR = Int + \theta DPRDR_{ut} + \beta TIM + \gamma DTPPRDR_T + \delta DTBPRDR_t + \hat{\beta}_1 Ly_{t-1} + \hat{e}_t$

None of the models suffers from the serial correlation and all contain zero lags of the dependent variable. Variable deletion test showed that in each of the equations (DU, DT,DTB) are jointly significant at 1%,5%,10% levels of significance (see Appendix 3 Section a) .For the variables to be cointegrated linear combination should be I(0).[28]

[28] Holden Ken Thompson John (1992) Co-integration an- Introductory survey , Brotish reiew of Economic Issues

Determination of appropriate order of VAR

The unrestricted VAR model for .The unrestricted model for VAR [29] for $D2LER70$ and $D2LPPP70$

$$y_t = Int + \theta TIM + \sum_{I=1}^{P} \Lambda_i y_{t-1} + \Phi Z_t + u_t \quad {}^{(30)}$$

y_t-m x 1 vector of jointly determined endogenous variables here ($D2LER70$) and ($D2LPPP70$)

Int- intercept

Tim-linear time trend

p- order of VAR

Z_T-vector of exogenous variables (here DLPRDR and dummies for 1968; 1974; 1982) dummy variables are included to control for structural break

u_t m x 1 vector of unobserved disturbances

After "testing down" procedure about different lag lengths we can summarize the table for

Var Order	(4)		(3)		(2)		(1)	
	D2LER 70	D2LPPP 70	D2LER70	D2LPPP70	D2LER70	D2LPPP 70	D2LER 70	D2LPPP7 0
SC	√	x	√	x	√	x	√	x
FF	√	√	√	√	√	√	√	√
N	√	x	√	x	√	x	√	x
HET	√	√	√	√	√	√	√	√

√ Null not rejected at 5% level of significance
√ * H_0: borderline non rejection
X- Null rejected

[29] Relationship between two or more variables modelled as VAR. The value of a variable is expressed as a function of past , lagged values, one does not have to worry which variables are endogenous and which are exogenous all VAR variables are endogenous purely exogenous variables are included to allow for trend and seasonal l factors

[30] See Appendix 4 Section A VAR estimation results

selecting VAR order where endogenous variables are conditioned on intercept, trend. All of the deletion tests for the exogenous and deterministic variables showed that 3 dummies; constant and time trend are jointly significant.[31]

VAR(1)	2 LAGS	Conclusion
	P-VALUE	
Portmanteau test	It is not implemented [32]	/
LM-TYPE test for autocorrelation	0.1703	Probability of type 1 error if we reject the null of no serial correlation is 17%
Test for non-normality	0.0000	There is sufficient evidence to reject the null of non-normality

VAR(2)	P-VALUE		Conclusion
	2 lags	4lags	
Portmanteau test	It is not implemented		/
LM-TYPE test for autocorrelation	0.0096	0.0355	Probability of type 1 error if we reject the null of no serial correlation is 17%
Test for non-normality (Jarque –Bera)	0.0000	0.0000	There is sufficient evidence to reject the null of non-normality probability of type I error is 0

On the basis of [33] JMULTI diagnostics we find that appropriate order for unrestricted VAR of D2LER70 and D2PPP70 is one. The test of joint significance of the second lags of dependent

[31] See deletion tests for the exogenous and deterministic variables Appendices from Appendix 4 Section D Appendix4 Section N

[32] If there are exogenous variables in the model

[33] See Appendix 4 section B and appendix 4 section C

variables showed joint insignificance of the second lag of the variable giving support to the idea of choosing one lag[(34)]. All of the criteria suggested one lag of the dependent variable.[(35)]

OPTIMAL ENDOGENOUS LAGS FROM INFORMATION CRITERIA		
	VAR(1)	VAR(2)
Akaike Info Criterion	1	1
Final Prediction Error	1	1
Hannan-Quinn Criterion	1	1
Schwarz Criterion	1	1

Estimated VAR by JMULTI

$$\begin{bmatrix} \text{STDMER\_70\_LOG\_d1(t)} \\ \text{PPP70\_log \_d1(t)} \end{bmatrix}$$

$$= \begin{bmatrix} 0.251 & 0.461 \\ 0.070 & 0.758 \end{bmatrix} \begin{bmatrix} \text{STDMER\_70\_LOG\_d1}(t-1) \\ \text{PPP70\_log \_d1}(t-1) \end{bmatrix}$$

$$+ \begin{bmatrix} -0.666 \\ 0.245 \end{bmatrix} [\text{PRDRATIO\_}LOG\_d1(t)]$$

$$+ \begin{bmatrix} -0.112 & -0.0180.155 & -0.020 \\ -0.020 & -0.0420.021 & -0.002 \end{bmatrix} \begin{bmatrix} \text{dtber70imp(t)} \\ \text{dtbppp70imp(t)} \\ \text{dtbprdrimp(t)} \\ \text{CONST} \end{bmatrix}$$

$$+ \begin{bmatrix} u1(t) \\ u2(t) \end{bmatrix}$$

[34] Wald test see Appendix 5 Section A
[35] See Appendix 6 Section A

Testing for co-integration

This is going to be done by the Pantula principle as joint test of the number of co- integrating vectors and of the presence / absence of deterministic components. The co- integration test s based on the following model

$$y_t = D_t + x_t;$$

$y_t = k$ determining vector of observable variables;

$D_t = \mu_0 + \mu_1 t$, and $x_t - is\ VAR(p)\ process\ with\ VECM$

$\Delta X_t = \Pi X_{t-1} + \sum_{j=1}^{p-1} \Gamma_j \Delta y_{t-j} + u_t$ u_t is white noise and cointegration test checks for two pairs of hypothesis

$H_0(r_0): \mathrm{rk}(\Pi) = \mathrm{r}_0$ versus $\mathrm{H}_1(\mathrm{r}_0): \mathrm{rk}(\Pi) > \mathrm{r}_0,\quad \mathrm{r}_0 = 0, \dots \dots.., \mathrm{K} - 1$

By Pantula principle it is determined that [36]

Pantula principle in determining the number of cointegrating vectors and deterministic components in the VECM Maximal Eigenvalue of the Stochastic Matrix (λ_{max})

Number of vectors.	Option 1	Option 2	Option 3	Option 4	Option 5
0	X	X	X	X	X
1	√	Not rejected-Stop [37]			

x-rejected at 95% critical value
√ not rejected at 95% critical value

[36] See Appendix 7A;7B;7C;7D
[37] We stop with the testing procedure at the first time when null hypothesis is not rejected

Because of previously detected non-normality on the basis of on Maximal Eigenvalue of the Stochastic Matrix (λ_{max}) and the Trace of the stochastic matrix (λ_{trace}) starting with the most restricted option 1 and proceeding to the least restricted option 5.

Pantula principle in determining the number of CV's and deterministic components in the VECM Trace of the Stochastic Matrix (λ_{trace})					
Number of vectors.	**Option 1**	**Option 2**	**Option 3**	**Option 4**	**Option 5**
0	X	X	X	X	X
1	√	Not rejected-Stop			
x-rejected at 5% level of significance √ not rejected at 95% critical value					

Information criteria support previous conclusion [38]			
Information criteria for option 2			
	AIC	SCB	HQC
r=0	129.1695	122.7258	126.8978
r=1	133.1104	123.4449	129.7029
r=2	132.8891	121.6127	128.9136

According to option 2 (restricted intercept and no trend) VECM model [39] is

$$\Delta y_t = \Pi^* \begin{bmatrix} y_{t-1} \\ 1 \end{bmatrix} + \lambda D + u_t$$

[38] In empirical macroeconomics analysis of small open economies " for the purpose of modelling macroeconomic relations macroeconomic agregats are often treated as I(1) exogenous variables

[39] There is no matrix of coefficients on differenced endogenous variables VAR(1) so no differenced endogenous variables appear in the model.

Π^* – matrix of short run coefficients(speed of adjustment of every variable towards equilibrium)

D- vector of exogenous variables DLPRDR for it's role towards short run adjustment towards equilibrium

λ coefficient on the matrix of Matrix of exogenous variables

1 Stands for the restricted intercept in the long run

Δy_t vector of DLER70 and DLPPP70

And three impuls dummies for 1968, 1974, 1981

u_t- usual white noise error term;

While general model for VECM is

$$\Delta y_t = \mu_0 + \delta_0 T + A\Delta y_{t-k} + a \begin{bmatrix} \beta \\ \mu_1 \\ \delta_1 \end{bmatrix} y_{t-1} + \phi D + u_t$$

y vector of endogenous variables

A Matrix of coefficients on the differenced endogenous variables

T- Deterministic trend

D vector of exogenous dummy variables

μ_0 And δ_0 unrestricted intercept and trend

β matrix on long run coefficients

u_i denotes disturbance term

Johansen Trace Test for: STDMER70_log_d1 PPP70_log_d1					
Number Of Vectors	Statistics from JMULTI software [40]				
r0	LR	pval	90%	95%	99%
0	14.82	0.2420	17.98	20.16	24.69
1	2.31	0.7161	7.60	9.14	12.53

Since LR (2.31) is less than value at 95% 9.14 statistics indicates about the appropriate number of vectors is 1 or 0(**14.82<20.16)**

From the info criteria from JMULTI [41]	
Number of vectors	
	r_0
Akaike Info Criterion	1
Final Prediction Error	1
Hannan-Quinn Criterion	1
Schwarz Criterion	1

Number of vectors	Johansen Trace Test including intercept and time trend				
r0	LR	pval	90%	95%	99%
0	16.82	0.4369	23.32	25.73	30.67
1	3.69	0.7817	10.68	12.45	16.22

And all of the information criteria showed that the Numbers of vectors is one. For VAR (2) the following it is found

---

40 See Appendix 7 Section F

41 See Appendix 7 Section F

Number of vectors	Johansen Trace Test including intercept and time trend				
r0	LR	pval	90%	95%	99%
0	19.75	0.2432	23.32	25.73	30.67
1	3.48	0.7817	10.68	12.45	16.22

And , from the info criteria, most reliable Schwarz Bayesian criteria indicating 1 cointegrating vector.

Obtaining the co-integrating vector

After we obtained the number of co-integrated vectors we continue further to see whether the CV tells us something about the long run relationship into the model. Just identifying restrictions are imposed automatically co-integrating vectors are normalized by setting to one for the model to be a reduced form Γ - matrix should be an identity matrix by setting one restriction A1=1(Normalization on DLER70) in MFIT and automatically done in JMULTI (identification is achieved by setting 0 restrictions on DLPPP70 second element in VAR) the following coefficient matrix it is obtained[42]

$$\begin{aligned}
&\mathrm{d(STDMER70_log\ _d1)(t)} \\
&\quad \mathrm{d(PPP70_log\ _d1)(t)} \\
&= \begin{bmatrix} -0.681 \\ 0.167 \end{bmatrix} \left[\begin{bmatrix} 1.000 & -0.983 \end{bmatrix} \begin{bmatrix} \mathrm{STDMER_log\ _d1(t-1)} \\ \mathrm{PPP70_log\ _d1(t-1)} \end{bmatrix} \right] \\
&+ \begin{bmatrix} -0.060 & -0.016 & 0.073 \end{bmatrix} \begin{bmatrix} \mathrm{dtber70imp(t-1)} \\ \mathrm{dtbppp70imp(t-1)} \\ \mathrm{dtbprdrim70(t-1)} \end{bmatrix} \\
&+ \begin{bmatrix} 0.295 & 0.234 \\ -0.038 & -0.037 \end{bmatrix} \begin{bmatrix} \mathrm{d(STDMER70_log\ _d1)(t-1)} \\ \mathrm{d(PPP70_log\ _d1)(t-1)} \end{bmatrix} + \begin{bmatrix} -0.011 & -0.000 \\ -0.002 & -0.000 \end{bmatrix} \begin{bmatrix} \mathrm{CONST} \\ \mathrm{trnd(t)} \end{bmatrix} \\
&+ \begin{bmatrix} \mathrm{u1(t)} \\ \mathrm{u2(t)} \end{bmatrix}
\end{aligned}$$

[42] See Appendix 7 Section K for the output estimation in JMULTI

T statistics matrix is presented next estimation technique is S2S one stage Simple two step estimation which is suitable for VECM and there must be specified restrictions on Γ_0

t- Values matrix

$$\begin{matrix} d(STDMER70\_log\ \_d1)(t) \\ d(PPP70\_log\ \_d1)(t) \end{matrix}$$

$$= \begin{bmatrix} -2.7581 \\ 2.129 \end{bmatrix} \left[[\ldots.. \quad -2.754] \begin{bmatrix} STDMER\_log\ \_d1(t-1) \\ PPP70\_log\ \_d1(t-1) \end{bmatrix} \right]$$

$$+ [-0.835 \quad -1.549 \quad 0.962] \begin{bmatrix} dtber70imp(t-1) \\ dtbppp70imp(t-1) \\ dtbprdrim70(t-1) \end{bmatrix}$$

$$+ \begin{bmatrix} 1.4333 & 0.546 \\ -0.586 & -0.271 \end{bmatrix} \begin{bmatrix} d(STDMER70\_log\ \_d1)(t-1) \\ d(PPP70\_log\ \_d1)(t-1) \end{bmatrix} + \begin{bmatrix} -0.544 & -0.356 \\ -0.299 & -0.718 \end{bmatrix} \begin{bmatrix} CONST \\ trnd(t) \end{bmatrix}$$

$$+ \begin{bmatrix} u1(t) \\ u2(t) \end{bmatrix}$$

Coefficients on constant in the deterministic matrix are insignificant

CONST |	-0.011	-0.002
|	(0.021)	(0.007)
|	{0.586}	{0.765}
|	[-0.544]	[-0.299]

While coefficients on first difference purchasing power parity is significant [43]

PPP70_log_d1 (t-1) |	-0.983
|	(0.357)
|	{0.006}
|	[-2.754]

Results and test from Mfit[44] confirms previous notation Likelihood ratio test of exactly identified restrictions test confirms that constant is insignificant variable therefore we can confirm that there is long-run relationship in which the changes in Exchange rate are positively correlated with the changes of ratio of German Consumer Price Index (CPI) to the UK Retail Price Index (RPI).

[43] See Appendix 7 Section K for the output estimation
[44] See Appendix 7 Section J ML test for exactly identifying restrictions

In order to test for relative PPP to support the theoretical relationship between the variables restrictions are put on the PPP knowing that PPP and that downward movement in the series indicates increase of UK price level relative to German price level. UK Sterling Exchange rate with German mark gives STDMER70 variable.DLPPP70 variable has a proportionate effect on changes of 1st difference log Exchange Rate. The results from the WALD test [45] in JMULTI showed that test statistics supports the restrictions that are underlined supportive of the theory. Test statistic is 1.257 probability of type 1 error is 0.27 indicating high probability of type 1 error in a case to reject the null hypothesis of accepting the restrictions. In microfit was tested the similar model [46]

$$\mathrm{DLER70} = \mathrm{CON} + \mathrm{DLPPP70}$$

And the results from the test showed that there is insufficient evidence to reject the null hypothesis of accepting the restrictions

DLER70	DLPPP70	CON
1	-1	0
LR test for restrictions $\chi^2$2 degrees of freedom 1.5577 prob.type I error (0.459)		

Estimated output from JMULTI co-integration vector of one overidentifying restriction is given in Appendix 8 Section C. But even if the statistics rejects restriction authorities in this area such as Pesaran and Pesaran suggest relying on the theory.

[45] See Appendix 8 Section B
[46] See Appendix 8 Section A

VECM

Error correction model is estimated for DLNER70 and DLPPP70 as system in JMULTI

$$\begin{bmatrix} \text{d(STDMER\_70\_LOG\_d1)(t1)} \\ \text{d(PPP\_70\_LOG\_d1)(t1)} \end{bmatrix}$$

$$= \begin{bmatrix} -0.681 \\ 0.167 \end{bmatrix} [[1.000 \quad -0.983]] \begin{bmatrix} \text{d(STDMER\_70\_log \_d1)(t}-1) \\ \text{d(PPP\_70\_LOG\_d1)(t}-1) \end{bmatrix}$$

$$+ [-0.060 - 0.116 \;\; 0.073] \begin{bmatrix} \text{dtber70imp(t}-1) \\ \text{dtbppp70imp(t}-1) \\ \text{dtbprdrimp(t}-1) \end{bmatrix}$$

$$+ \begin{bmatrix} 0.295 & 0.234 \\ -0.038 & -0.037 \end{bmatrix} \begin{bmatrix} \text{d(STDMER\_70\_LOG\_d1)(t}-1) \\ \text{d(PPP\_70\_LOG\_d1)(t}-1) \end{bmatrix}$$

$$+ \begin{bmatrix} -0.011 & -0.000 \\ -0.002 & -0.000 \end{bmatrix} \begin{bmatrix} \text{CONST} \\ \text{TREND(t)} \end{bmatrix} + \begin{bmatrix} u1(t) \\ u2(t) \end{bmatrix}$$

VECM Mechanism just identifying restrictions

$$\begin{bmatrix} * & 0 \\ 0 & * \end{bmatrix} \begin{bmatrix} \text{d(STDMER\_70\_LOG\_d1)(t)} \\ \text{d(PPP\_70\_LOG\_d1)(t)} \end{bmatrix} =$$

$$\begin{bmatrix} * \\ * \end{bmatrix} [\text{ect(t}-1)] + \begin{bmatrix} * & * \\ * & * \end{bmatrix} \begin{bmatrix} \text{d(STDMER\_70\_LOG\_d1)(t}-1 \\ \text{d(PPP\_70\_LOG\_d1)(t}-1) \end{bmatrix} + \begin{bmatrix} * \\ * \end{bmatrix} [\text{PRDRATIO\_log \_d(t)}] +$$

$$\begin{bmatrix} * & * \\ * & * \end{bmatrix} \begin{bmatrix} \text{const} \\ \text{trend} \end{bmatrix}$$

Matrix VEC model with T-statistics

$$\begin{bmatrix} \text{d(STDMER\_70\_LOG\_d1)(t1)} \\ \text{d(PPP\_70\_LOG\_d1)(t1)} \end{bmatrix}$$

$$= \begin{bmatrix} -2.758 \\ 2.129 \end{bmatrix} [[---- \quad -2.754]] \begin{bmatrix} \text{d(STDMER\_70\_log \_d1)(t}-1) \\ \text{d(PPP\_70\_LOG\_d1)(t}-1) \end{bmatrix}$$

$$+ [-0.835 - 2.115 \;\; 0.962] \begin{bmatrix} \text{dtber70imp(t}-1) \\ \text{dtbppp70imp(t}-1) \\ \text{dtbprdrimp(t}-1) \end{bmatrix}$$

$$+ \begin{bmatrix} 1.433 & 0.546 \\ -0.586 & -0.271 \end{bmatrix} \begin{bmatrix} \text{d(STDMER\_70\_LOG\_d1)(t}-1) \\ \text{d(PPP\_70\_LOG\_d1)(t}-1) \end{bmatrix}$$

$$+ \begin{bmatrix} -0.544 & -0.356 \\ -0.586 & -0.718 \end{bmatrix} \begin{bmatrix} \text{CONST} \\ \text{TREND(t)} \end{bmatrix} + \begin{bmatrix} \text{u1(t)} \\ \text{u2(t)} \end{bmatrix}$$

T-stat higher than 2 indicates significant coefficients. This form of EC vector is preferable over the one with restrictions on *B*-ta Matrix according to the diagnostics

VEC Just-identifying Restrictions [47]		Conclusion
	P-VALUE	
Portmanteau test	It is not implemented	/
LM-TYPE test for autocorrelation	0.2472	Probability of type 1 error if we reject the null of no serial correlation is 24%
Test for non-normality	0.2283	There is insufficient evidence to reject the null of non-normality probability of type I error is 22%

VEC over identifying restrictions on B-ta matrix	Conclusion	
	P-VALUE	
Portmanteau test	It is not implemented	/
LM-TYPE test for autocorrelation	0.0000	Probability of type 1 error if we reject the null of no serial correlation is 0% therefore we reject the null hypothesis
Test for non-normality	0.0115	There is sufficient evidence to reject the null of non-normality probability of type I error is 1,15% therefpre we reject the null of non-normality and accept normality

Also from JMULTI there are two additional tests of the models that give similar results

VECM Model Statistics[48]	Log Likelihood:
Just identifying Restrictions (constant terms only)	1.431364e+02
Models with constant and trend terms only	1.442889e+02

[47] See Appendix 8 Section E
[48] See Appendix 8 Section D

Error Correction Mechanism

	d(STDMER70_log_d1)	d(PPP70_log_d1)
ec1(t-1)	- 0.681	0.167
Std.dev	(0.247)	(0.079)
p-value	{0.006}	{0.033}
t-ratio	[-2.758]	[2.129]

In each EC model there is an EC mechanism and coefficient on the cointegrating vector measures the rate per period at which one of the endogenous variables adjusts. In the first equation the error correction mechanism is highly significant [49] and negative. If the system is out of equilibrium, alteration in the change of the exchange rates will be downward (everything else ceteris paribus) compensating around 68% of the disequilibrium per year. In the second equation error correction mechanism is also highly significant but positive[50]meaning that if the system is in disequilibrium changes of change in the ratio of German CPI relative to UK Retail Price index will rise offsetting 15% of the disequilibrium per year until the equilibrium rate of exchange rate will be achieved. Coefficient on the ECM indicates that it will take much longer for d(PPP70_log_d1) to get d(STDMER70_log_d1) on the equilibrium level.

Relative Productivity Growth

a significant negative impact, devaluation in 1967, regime change in UK are insignificant. Statistical test suggested that Relative productivity growth DLPRDR is insignificant in the two equations at the conventional levels of significance [51].Model implies that $\frac{\text{German productivity}}{\text{UK PRODUCTIVITY}}$ doesn't have significant influence on explaining on relative change on prices not even on the exchange rate contrary to Pugh, Beachil study [52] and other studies in simple macroeconomic models real sector changes suppose to have influence on nominal variables changes. Underlying theory for PPP was not rejected about the long run proportional relationship with ER. Bretton Woods fall has

[49] (p-value is 0.006)

[50] P-value is 0.033

[51] It might be significant at the higher levels of significance

[52] Productivity is fundamental determinant of PPP Balassa-Samuelson study provides theoretical underpinning for what De Grauwe (1989) terms a productivity –adjusted PPP relationship. Pugh and Beachil at the end find that impact of differential productivity growth on nominal exchange rates is with the expected sign positive as theory predicts coefficients will be between zero and one.

Appendix Appendix 1 Section A

Variables definitions

STDMER70: this is the indirect quote UK sterling exchange rate with the German Mark (DM) (i.e., DM per £1, so
that a downward movement in the series indicates depreciation of sterling, and an upward movement appreciation
of sterling). The observations are average annual rates from 1950 to 1988 in index form (1970=100).

PPP70: is the ratio of the German Consumer Price Index (CPI) to the UK Retail Price Index (RPI). These are -
respectively - the most general and comparable German and UK price indices. PPP70 - the ratio German CPI /
UK RPI - gives annual values for absolute purchasing power parity (PPP) from 1950 to 1988 in index form
(1970=100). Downward (upward) movement in the series indicates increase (decrease) of the UK price level relative
to the German price level.

PRDRATIO: is the UK: German ratio of labour productivity in manufacturing industry from 1950 to 1988.
Downward (upward) movement in the series indicates increase (decrease) of German productivity relative to UK
productivity.

Appendix 2 Section a

Extract from MFIT of the Peron's terms created for STDMER70 variable

OBS.	CONSTANT	TIM	DTBER70	DUER70	DTPRDR
1950	1.0000	1.0000	0.00	0.00	0.00
1951	1.0000	2.0000	0.00	0.00	0.00
1952	1.0000	3.0000	0.00	0.00	0.00
1953	1.0000	4.0000	0.00	0.00	0.00
1954	1.0000	5.0000	0.00	0.00	0.00
1955	1.0000	6.0000	0.00	0.00	0.00
1956	1.0000	7.0000	0.00	0.00	0.00
1957	1.0000	8.0000	0.00	0.00	0.00
1958	1.0000	9.0000	0.00	0.00	0.00
1959	1.0000	10.0000	0.00	0.00	0.00
1960	1.0000	11.0000	0.00	0.00	0.00
1961	1.0000	12.0000	0.00	0.00	0.00
1962	1.0000	13.0000	0.00	0.00	0.00
1963	1.0000	14.0000	0.00	0.00	0.00
1964	1.0000	15.0000	0.00	0.00	0.00
1965	1.0000	16.0000	0.00	0.00	0.00
1966	1.0000	17.0000	0.00	0.00	0.00
1967	1.0000	18.0000	0.00	0.00	0.00
1968	1.0000	19.0000	1.0000	1.0000	0.00
1969	1.0000	20.0000	0.00	1.0000	0.00
1970	1.0000	21.0000	0.00	1.0000	0.00
1971	1.0000	22.0000	0.00	1.0000	0.00
1972	1.0000	23.0000	0.00	1.0000	0.00
1973	1.0000	24.0000	0.00	1.0000	0.00
1974	1.0000	25.0000	0.00	1.0000	0.00
1975	1.0000	26.0000	0.00	1.0000	0.00
1976	1.0000	27.0000	0.00	1.0000	0.00
1977	1.0000	28.0000	0.00	1.0000	0.00
1978	1.0000	29.0000	0.00	1.0000	0.00
1979	1.0000	30.0000	0.00	1.0000	0.00
1980	1.0000	31.0000	0.00	1.0000	0.00
1981	1.0000	32.0000	0.00	1.0000	32.0000
1982	1.0000	33.0000	0.00	1.0000	33.0000
1983	1.0000	34.0000	0.00	1.0000	34.0000
1984	1.0000	35.0000	0.00	1.0000	35.0000
1985	1.0000	36.0000	0.00	1.0000	36.0000
1986	1.0000	37.0000	0.00	1.0000	37.0000

```
1987 1.0000 38.0000 0.00 1.0000 38.0000
1988 1.0000 39.0000 0.00 1.0000 39.0000
```

Extract from MFIT of the Peron’s terms created for PRDRATIO variable

```
OBS. CONSTANT TIM DTBPRDR DUPRDR DTPRDR
1950 1.0000 1.0000 0.00 0.00 0.00
1951 1.0000 2.0000 0.00 0.00 0.00
1952 1.0000 3.0000 0.00 0.00 0.00
1953 1.0000 4.0000 0.00 0.00 0.00
1954 1.0000 5.0000 0.00 0.00 0.00
1955 1.0000 6.0000 0.00 0.00 0.00
1956 1.0000 7.0000 0.00 0.00 0.00
1957 1.0000 8.0000 0.00 0.00 0.00
1958 1.0000 9.0000 0.00 0.00 0.00
1959 1.0000 10.0000 0.00 0.00 0.00
1960 1.0000 11.0000 0.00 0.00 0.00
1961 1.0000 12.0000 0.00 0.00 0.00
1962 1.0000 13.0000 0.00 0.00 0.00
1963 1.0000 14.0000 0.00 0.00 0.00
1964 1.0000 15.0000 0.00 0.00 0.00
1965 1.0000 16.0000 0.00 0.00 0.00
1966 1.0000 17.0000 0.00 0.00 0.00
1967 1.0000 18.0000 0.00 0.00 0.00
1968 1.0000 19.0000 0.00 0.00 0.00
1969 1.0000 20.0000 0.00 0.00 0.00
1970 1.0000 21.0000 0.00 0.00 0.00
1971 1.0000 22.0000 0.00 0.00 0.00
1972 1.0000 23.0000 0.00 0.00 0.00
1973 1.0000 24.0000 0.00 0.00 0.00
1974 1.0000 25.0000 0.00 0.00 0.00
1975 1.0000 26.0000 0.00 0.00 0.00
1976 1.0000 27.0000 0.00 0.00 0.00
1977 1.0000 28.0000 0.00 0.00 0.00
1978 1.0000 29.0000 0.00 0.00 0.00
1979 1.0000 30.0000 0.00 0.00 0.00
1980 1.0000 31.0000 0.00 0.00 0.00
1981 1.0000 32.0000 1.0000 1.0000 32.0000
1982 1.0000 33.0000 0.00 1.0000 33.0000
1983 1.0000 34.0000 0.00 1.0000 34.0000
1984 1.0000 35.0000 0.00 1.0000 35.0000
1985 1.0000 36.0000 0.00 1.0000 36.0000
1986 1.0000 37.0000 0.00 1.0000 37.0000
1987 1.0000 38.0000 0.00 1.0000 38.0000
1988 1.0000 39.0000 0.00 1.0000 39.0000
```

Extract from MFIT of the Peron’s terms created for PPP70 variable

```
OBS. CONSTANT TIM DTBPPP70 DUPPP70 DTPPP70
1950 1.0000 1.0000 0.00 0.00 0.00
1951 1.0000 2.0000 0.00 0.00 0.00
1952 1.0000 3.0000 0.00 0.00 0.00
1953 1.0000 4.0000 0.00 0.00 0.00
1954 1.0000 5.0000 0.00 0.00 0.00
1955 1.0000 6.0000 0.00 0.00 0.00
1956 1.0000 7.0000 0.00 0.00 0.00
1957 1.0000 8.0000 0.00 0.00 0.00
1958 1.0000 9.0000 0.00 0.00 0.00
1959 1.0000 10.0000 0.00 0.00 0.00
1960 1.0000 11.0000 0.00 0.00 0.00
1961 1.0000 12.0000 0.00 0.00 0.00
1962 1.0000 13.0000 0.00 0.00 0.00
1963 1.0000 14.0000 0.00 0.00 0.00
1964 1.0000 15.0000 0.00 0.00 0.00
1965 1.0000 16.0000 0.00 0.00 0.00
1966 1.0000 17.0000 0.00 0.00 0.00
1967 1.0000 18.0000 0.00 0.00 0.00
1968 1.0000 19.0000 0.00 0.00 0.00
1969 1.0000 20.0000 0.00 0.00 0.00
1970 1.0000 21.0000 0.00 0.00 0.00
1971 1.0000 22.0000 0.00 0.00 0.00
1972 1.0000 23.0000 0.00 0.00 0.00
1973 1.0000 24.0000 0.00 0.00 0.00
1974 1.0000 25.0000 1.0000 1.0000 25.0000
1975 1.0000 26.0000 0.00 1.0000 26.0000
1976 1.0000 27.0000 0.00 1.0000 27.0000
1977 1.0000 28.0000 0.00 1.0000 28.0000
1978 1.0000 29.0000 0.00 1.0000 29.0000
1979 1.0000 30.0000 0.00 1.0000 30.0000
```

```
1980 1.0000 31.0000 0.00 1.0000 31.0000
1981 1.0000 32.0000 0.00 1.0000 32.0000
1982 1.0000 33.0000 0.00 1.0000 33.0000
1983 1.0000 34.0000 0.00 1.0000 34.0000
1984 1.0000 35.0000 0.00 1.0000 35.0000
1985 1.0000 36.0000 0.00 1.0000 36.0000
1986 1.0000 37.0000 0.00 1.0000 37.0000
1987 1.0000 38.0000 0.00 1.0000 38.0000
```

Appendix 2 Section B

1a.) Testing

ADF -Peronn procedure for the levels and log levels of the variables

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is DER70
38 observations used for estimation from 1951 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT       13.1133 10.7043 1.2251[.229]
TIM            -.12095 .17309 -.69877[.490]
DTER70          .10743 .33421  .32144[.750]
DTBER70        -6.5570 4.1077 -1.5963[.120]
DUER70        -10.4698 5.3269 -1.9655[.058]
STDMER701    -.094637 .076776 -1.2326[.227]
*******************************************************************************
R-Squared .50252 R-Bar-Squared .42479
S.E. of Regression 3.3993 F-stat. F( 5, 32) 6.4649[.000]
Mean of Dependent Variable -2.6132 S.D. of Dependent Variable 4.4821
Residual Sum of Squares 369.7759 Equation Log-likelihood -97.1506
Akaike Info. Criterion -103.1506 Schwarz Bayesian Criterion -108.0633
DW-statistic 1.4835
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 2.7771[.096]*F( 1, 31)= 2.4442[.128]*
* * * *
* B:Functional Form *CHSQ( 1)= 11.3870[.001]*F( 1, 31)= 13.2640[.001]*
* * * *
* C:Normality *CHSQ( 2)= 7.7630[.021]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .24362[.622]*F( 1, 36)= .23228[.633]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

1. ADF PERRON test for the levels of the variables of interest STDMER70 PPP70 PRDRATIO

Ordinary least squares estimation with 1 lag of the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is DER70
37 observations used for estimation from 1952 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT       14.3602 11.0445 1.3002[.203]
TIM            -.14858 .19308 -.76956[.448]
DTER70          .053225 .36187 .14708[.884]
DTBER70        -7.2262 4.2809 -1.6880[.102]
DUER70         -8.3127 6.3446 -1.3102[.200]
STDMER701     -.10094 .078665 -1.2832[.209]
DER70(-1)        .13056 .16575 .78768[.437]
*******************************************************************************
R-Squared .51287 R-Bar-Squared .41545
S.E. of Regression 3.4679 F-stat. F( 6, 30) 5.2642[.001]
Mean of Dependent Variable -2.6568 S.D. of Dependent Variable 4.5358
Residual Sum of Squares 360.7829 Equation Log-likelihood -94.6319
Akaike Info. Criterion -101.6319 Schwarz Bayesian Criterion -107.2701
DW-statistic 1.6971 Durbin's h-statistic *NONE*
*******************************************************************************
```

```
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 7.0681[.008]*F( 1, 29)= 6.8480[.014]*
* * * *
* B:Functional Form *CHSQ( 1)= 16.8768[.000]*F( 1, 29)= 24.3216[.000]*
* * * *
* C:Normality *CHSQ( 2)= 8.7257[.013]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .50119[.479]*F( 1, 35)= .48061[.493]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Ordinary least squares with -2 lags of the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is DER70
36 observations used for estimation from 1953 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT       14.7284 11.8531 1.2426[.224]
TIM           -.12812 .21979 -.58291[.565]
DTER70        -.0050165 .40615 -.012351[.990]
DTBER70       -7.5532 4.5433 -1.6625[.108]
DUER70        -7.0440 7.5093 -.93804[.356]
STDMER701     -.10565 .083670 -1.2627[.217]
DER70(-1)      .13188 .17127 .77003[.448]
DER70(-2)     .048692 .17042 .28572[.777]
*******************************************************************************
R-Squared .50609 R-Bar-Squared .38261
S.E. of Regression 3.5808 F-stat. F( 7, 28) 4.0986[.003]
Mean of Dependent Variable -2.7583 S.D. of Dependent Variable 4.5572
Residual Sum of Squares 359.0195 Equation Log-likelihood -92.4792
Akaike Info. Criterion -100.4792 Schwarz Bayesian Criterion -106.8133
DW-statistic 1.6919
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 7.2114[.007]*F( 1, 27)= 6.7633[.015]*
* * * *
* B:Functional Form *CHSQ( 1)= 16.7047[.000]*F( 1, 27)= 23.3749[.000]*
* * * *
* C:Normality *CHSQ( 2)= 9.1903[.010]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .29818[.585]*F( 1, 34)= .28397[.598]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Ordinary least squares estimation – with 3 lags of the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is DER70
35 observations used for estimation from 1954 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 21.5749 13.1036 1.6465[.112]
TIM -.16990 .24492 -.69369[.494]
DTER70 -.23903 .47296 -.50540[.618]
DTBER70 -8.7294 4.6770 -1.8665[.073]
DUER70 -1.7400 8.9836 -.19369[.848]
STDMER701 -.15243 .092351 -1.6506[.111]
DER70(-1) .16732 .17476 .95741[.347]
DER70(-2) .048629 .17177 .28311[.779]
DER70(-3) .21999 .17971 1.2241[.232]
*******************************************************************************
```

```
R-Squared .53281 R-Bar-Squared .38906
S.E. of Regression 3.6061 F-stat. F( 8, 26) 3.7065[.005]
Mean of Dependent Variable -2.8086 S.D. of Dependent Variable 4.6136
Residual Sum of Squares 338.1082 Equation Log-likelihood -89.3532
Akaike Info. Criterion -98.3532 Schwarz Bayesian Criterion -105.3522
DW-statistic 1.6826
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 4.7301[.030]*F( 1, 25)= 3.9066[.059]*
* * * *
* B:Functional Form *CHSQ( 1)= 14.1053[.000]*F( 1, 25)= 16.8767[.000]*
* * * *
* C:Normality *CHSQ( 2)= 4.0535[.132]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .93430[.334]*F( 1, 33)= .90507[.348]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Ordinary least squares estimation – with 4 lags of the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is DER70
34 observations used for estimation from 1955 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 23.7803 15.5518 1.5291[.139]
TIM -.17319 .28467 -.60838[.549]
DTER70 -.31666 .56188 -.56358[.578]
DTBER70 -8.7878 4.8625 -1.8072[.083]
DUER70 -.24390 10.6152 -.022977[.982]
STDMER701 -.16867 .10944 -1.5413[.136]
DER70(-1) .17327 .18264 .94873[.352]
DER70(-2) .056028 .18044 .31050[.759]
DER70(-3) .21976 .18689 1.1758[.251]
DER70(-4) .057458 .18564 .30952[.760]
*******************************************************************************
R-Squared .52939 R-Bar-Squared .35291
S.E. of Regression 3.7459 F-stat. F( 9, 24) 2.9998[.015]
Mean of Dependent Variable -2.8912 S.D. of Dependent Variable 4.6567
Residual Sum of Squares 336.7618 Equation Log-likelihood -87.2252
Akaike Info. Criterion -97.2252 Schwarz Bayesian Criterion -104.8570
DW-statistic 1.6969
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 4.7670[.029]*F( 1, 23)= 3.7506[.065]*
* * * *
* B:Functional Form *CHSQ( 1)= 14.1802[.000]*F( 1, 23)= 16.4554[.000]*
* * * *
* C:Normality *CHSQ( 2)= 4.0721[.131]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .67140[.413]*F( 1, 32)= .64463[.428]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Ordinary Least Squares Estimation- with 5 lags of the dependent variable

```
*******************************************************************************
Dependent variable is DER70
33 observations used for estimation from 1956 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 36.4832 17.7744 2.0526[.052]
TIM -.20065 .31904 -.62894[.536]
DTER70 -.74251 .64486 -1.1514[.262]
DTBER70 -9.4736 4.8611 -1.9489[.064]
```

```
DUER70 8.0454 12.1319 .66316[.514]
STDMER701 -.26097 .12520 -2.0844[.049]
DER70(-1) .24180 .18746 1.2899[.210]
DER70(-2) .089959 .18114 .49663[.624]
DER70(-3) .27020 .18927 1.4276[.167]
DER70(-4) .058803 .18493 .31798[.754]
DER70(-5) .27928 .18712 1.4925[.150]
*******************************************************************************
R-Squared .56756 R-Bar-Squared .37100
S.E. of Regression 3.7278 F-stat. F( 10, 22) 2.8874[.018]
Mean of Dependent Variable -2.9788 S.D. of Dependent Variable 4.7003
Residual Sum of Squares 305.7237 Equation Log-likelihood -83.5568
Akaike Info. Criterion -94.5568 Schwarz Bayesian Criterion -102.7876
DW-statistic 1.6289
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 3.8722[.049]*F( 1, 21)= 2.7917[.110]*
* * * *
* B:Functional Form *CHSQ( 1)= .58328[.445]*F( 1, 21)= .37786[.545]*
* * * *
* C:Normality *CHSQ( 2)= .15413[.926]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .96404[.326]*F( 1, 31)= .93286[.342]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Ordinary least squares estimation - with 6 lags on the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is DER70
32 observations used for estimation from 1957 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 42.0890 23.7412 1.7728[.091]
TIM -.19018 .38017 -.50027[.622]
DTER70 -.95631 .84078 -1.1374[.269]
DTBER70 -9.5124 5.0765 -1.8738[.076]
DUER70 11.8921 15.5594 .76431[.454]
STDMER701 -.30438 .16868 -1.8045[.086]
DER70(-1) .25451 .19828 1.2836[.214]
DER70(-2) .11748 .20108 .58427[.566]
DER70(-3) .29272 .20464 1.4304[.168]
DER70(-4) .077749 .19973 .38928[.701]
DER70(-5) .28683 .19629 1.4613[.159]
DER70(-6) .088930 .21731 .40924[.687]
*******************************************************************************
R-Squared .56583 R-Bar-Squared .32703
S.E. of Regression 3.8922 F-stat. F( 11, 20) 2.3695[.045]
Mean of Dependent Variable -3.0719 S.D. of Dependent Variable 4.7445
Residual Sum of Squares 302.9779 Equation Log-likelihood -81.3728
Akaike Info. Criterion -93.3728 Schwarz Bayesian Criterion -102.1672
DW-statistic 1.5997
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 5.0277[.025]*F( 1, 19)= 3.5416[.075]*
* * * *
* B:Functional Form *CHSQ( 1)= 1.0337[.309]*F( 1, 19)= .63427[.436]*
* * * *
* C:Normality *CHSQ( 2)= .19364[.908]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .63490[.426]*F( 1, 30)= .60727[.442]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Ordinary least squares estimation- with 7 lags of the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is DER70
31 observations used for estimation from 1958 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 58.2937 35.7356 1.6312[.120]
TIM -.25075 .46752 -.53633[.598]
DTER70 -1.4518 1.1889 -1.2211[.238]
DTBER70 -9.1388 5.3243 -1.7165[.103]
DUER70 21.5141 22.3481 .96268[.348]
STDMER701 -.42064 .25351 -1.6592[.114]
DER70(-1) .33674 .24401 1.3801[.184]
DER70(-2) .16223 .22108 .73378[.473]
DER70(-3) .37381 .24849 1.5043[.150]
DER70(-4) .13187 .22499 .58611[.565]
DER70(-5) .33431 .21813 1.5326[.143]
DER70(-6) .13161 .23656 .55634[.585]
DER70(-7) .16808 .26420 .63618[.533]
*******************************************************************************
R-Squared .56938 R-Bar-Squared .28230
S.E. of Regression 4.0572 F-stat. F( 12, 18) 1.9834[.092]
Mean of Dependent Variable -3.1710 S.D. of Dependent Variable 4.7892
Residual Sum of Squares 296.3010 Equation Log-likelihood -78.9766
Akaike Info. Criterion -91.9766 Schwarz Bayesian Criterion -101.2975
DW-statistic 1.6595
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 2.5084[.113]*F( 1, 17)= 1.4967[.238]*
* * * *
* B:Functional Form *CHSQ( 1)= .73843[.390]*F( 1, 17)= .41482[.528]*
* * * *
* C:Normality *CHSQ( 2)= .19811[.906]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .50484[.477]*F( 1, 29)= .48008[.494]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

1b) Testing down procedure **ADF -Peronn procedure** for PPP70 VARIABLE

```
Ordinary least squares estimation with 4 lags of the dependent variable
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is DPPP70
34 observations used for estimation from 1955 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 48.5419 10.7864 4.5003[.000]
TIM -.57847 .13019 -4.4432[.000]
DTPPP70 -.28410 .23730 -1.1972[.243]
DTBPPP70 4.0261 2.0675 1.9473[.063]
DUPPP70 -3.0563 6.0114 -.50841[.616]
PPP701 -.36204 .078718 -4.5993[.000]
DPPP70(-1) .25187 .15246 1.6520[.112]
DPPP70(-2) .089461 .15931 .56155[.580]
DPPP70(-3) .13497 .13176 1.0244[.316]
DPPP70(-4) .19726 .12347 1.5977[.123]
*******************************************************************************
R-Squared .84040 R-Bar-Squared .78056
S.E. of Regression 1.2836 F-stat. F( 9, 24) 14.0422[.000]
Mean of Dependent Variable -2.6382 S.D. of Dependent Variable 2.7401
Residual Sum of Squares 39.5416 Equation Log-likelihood -50.8108
Akaike Info. Criterion -60.8108 Schwarz Bayesian Criterion -68.4426
DW-statistic 1.8287
*******************************************************************************
Diagnostic Tests
```

```
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= .42672[.514]*F( 1, 23)= .29233[.594]*
* * * *
* B:Functional Form *CHSQ( 1)= 1.7845[.182]*F( 1, 23)= 1.2740[.271]*
* * * *
* C:Normality *CHSQ( 2)= .79655[.671]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= 1.5784[.209]*F( 1, 32)= 1.5579[.221]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Ordinary least squares estimation with 3 lags of the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is DPPP70
34 observations used for estimation from 1955 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 38.9375 9.2299 4.2186[.000]
TIM -.46775 .11359 -4.1180[.000]
DTPPP70 -.10008 .21382 -.46805[.644]
DTBPPP70 3.8546 2.1279 1.8115[.082]
DUPPP70 -7.3017 5.5572 -1.3139[.201]
PPP701 -.29413 .068281 -4.3076[.000]
DPPP70(-1) .27314 .15652 1.7450[.093]
DPPP70(-2) -.0097752 .15119 -.064654[.949]
DPPP70(-3) .21454 .12572 1.7065[.100]
*******************************************************************************
R-Squared .82343 R-Bar-Squared .76693
S.E. of Regression 1.3228 F-stat. F( 8, 25) 14.5732[.000]
Mean of Dependent Variable -2.6382 S.D. of Dependent Variable 2.7401
Residual Sum of Squares 43.7474 Equation Log-likelihood -52.5291
Akaike Info. Criterion -61.5291 Schwarz Bayesian Criterion -68.3977
DW-statistic 1.8023
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 1.1190[.290]*F( 1, 24)= .81674[.375]*
* * * *
* B:Functional Form *CHSQ( 1)= .53711[.464]*F( 1, 24)= .38523[.541]*
* * * *
* C:Normality *CHSQ( 2)= 2.2769[.320]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= 3.5836[.058]*F( 1, 32)= 3.7701[.061]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Ordinary least squares estimation with two lags of the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is DPPP70
36 observations used for estimation from 1953 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 30.6967 8.4275 3.6424[.001]
TIM -.35894 .10223 -3.5110[.002]
DTPPP70 .015532 .17395 .089294[.929]
DTBPPP70 3.0255 2.0853 1.4509[.158]
DUPPP70 -9.7902 4.4820 -2.1843[.037]
PPP701 -.23759 .063035 -3.7692[.001]
DPPP70(-1) .31065 .12847 2.4180[.022]
DPPP70(-2) .027297 .12045 .22662[.822]
*******************************************************************************
R-Squared .79922 R-Bar-Squared .74903
S.E. of Regression 1.3635 F-stat. F( 7, 28) 15.9227[.000]
Mean of Dependent Variable -2.7139 S.D. of Dependent Variable 2.7217
```

```
Residual Sum of Squares 52.0537 Equation Log-likelihood -57.7194
Akaike Info. Criterion -65.7194 Schwarz Bayesian Criterion -72.0535
DW-statistic 1.9756
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= .2795E-3[.987]*F( 1, 27)= .2096E-3[.989]*
* * * *
* B:Functional Form *CHSQ( 1)= .0038883[.950]*F( 1, 27)= .0029166[.957]*
* * * *
* C:Normality *CHSQ( 2)= .16020[.923]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= 2.2484[.134]*F( 1, 34)= 2.2650[.142]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Ordinary least squares estimation with 1 lag of the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is DPPP70
36 observations used for estimation from 1953 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 29.7760 7.2618 4.1004[.000]
TIM -.34858 .089929 -3.8762[.001]
DTPPP70 .033203 .15292 .21712[.830]
DTBPPP70 3.0059 2.0491 1.4669[.153]
DUPPP70 -10.1731 4.0828 -2.4917[.019]
PPP701 -.23101 .055014 -4.1990[.000]
DPPP70(-1) .32352 .11332 2.8549[.008]
*******************************************************************************
R-Squared .79886 R-Bar-Squared .75724
S.E. of Regression 1.3410 F-stat. F( 6, 29) 19.1959[.000]
Mean of Dependent Variable -2.7139 S.D. of Dependent Variable 2.7217
Residual Sum of Squares 52.1492 Equation Log-likelihood -57.7524
Akaike Info. Criterion -64.7524 Schwarz Bayesian Criterion -70.2947
DW-statistic 1.9885 Durbin's h-statistic .046937[.963]
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= .8883E-3[.976]*F( 1, 28)= .6909E-3[.979]*
* * * *
* B:Functional Form *CHSQ( 1)= .0024861[.960]*F( 1, 28)= .0019338[.965]*
* * * *
* C:Normality *CHSQ( 2)= .14985[.928]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= 2.0620[.151]*F( 1, 34)= 2.0658[.160]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

1b) Testing down procedure **ADF -Peronn procedure** for PRDRATIO VARIABLE

```
Ordinary least squares estimation with 4 lags of the dependent variable
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is DPRDR
34 observations used for estimation from 1955 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 23.8078 11.5223 2.0662[.050]
TIM -.33858 .19065 -1.7759[.088]
DTPRDR .60626 .48175 1.2584[.220]
DUPRDR -15.2857 16.2073 -.94313[.355]
DTBPRDR .83862 2.4900 .33680[.739]
PRDRATIO1 -.18127 .072950 -2.4849[.020]
DPRDR(-1) .077249 .18148 .42566[.674]
```

```
DPRDR(-2) -.11778 .18038 -.65295[.520]
DPRDR(-3) .048994 .16124 .30385[.764]
DPRDR(-4) .8098E-3 .17007 .0047613[.996]
*******************************************************************************
R-Squared .73302 R-Bar-Squared .63290
S.E. of Regression 1.7233 F-stat. F( 9, 24) 7.3214[.000]
Mean of Dependent Variable -1.6971 S.D. of Dependent Variable 2.8442
Residual Sum of Squares 71.2713 Equation Log-likelihood -60.8262
Akaike Info. Criterion -70.8262 Schwarz Bayesian Criterion -78.4580
DW-statistic 2.0820
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 3.0441[.081]*F( 1, 23)= 2.2617[.146]*
* * * *
* B:Functional Form *CHSQ( 1)= 7.7720[.005]*F( 1, 23)= 6.8155[.016]*
* * * *
* C:Normality *CHSQ( 2)= .37539[.829]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .22430[.636]*F( 1, 32)= .21251[.648]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values


Ordinary least squares estimation with 3 lag of the dependent variable
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is DPRDR
35 observations used for estimation from 1954 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 19.0475 10.3359 1.8428[.077]
TIM -.26692 .17421 -1.5322[.138]
DTBPRDR .70839 2.4354 .29088[.773]
DUPRDR -12.0791 14.7140 -.82092[.419]
DTPRDR .50532 .43677 1.1570[.258]
PRDRATIO1 -.15178 .064767 -2.3435[.027]
DPRDR(-1) .10380 .17549 .59145[.559]
DPRDR(-2) -.18236 .15939 -1.1441[.263]
DPRDR(-3) .029223 .15349 .19039[.850]
*******************************************************************************
R-Squared .72650 R-Bar-Squared .64235
S.E. of Regression 1.6918 F-stat. F( 8, 26) 8.6332[.000]
Mean of Dependent Variable -1.7629 S.D. of Dependent Variable 2.8290
Residual Sum of Squares 74.4187 Equation Log-likelihood -62.8641
Akaike Info. Criterion -71.8641 Schwarz Bayesian Criterion -78.8632
DW-statistic 2.0916
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 1.7125[.191]*F( 1, 25)= 1.2861[.268]*
* * * *
* B:Functional Form *CHSQ( 1)= 4.4031[.036]*F( 1, 25)= 3.5976[.069]*
* * * *
* C:Normality *CHSQ( 2)= .52267[.770]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .50928[.475]*F( 1, 33)= .48727[.490]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

```
Ordinary least squares estimation with 2 lags of the dependent variable
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is DPRDR
35 observations used for estimation from 1954 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 19.2848 10.0757 1.9140[.066]
TIM -.26849 .17088 -1.5712[.128]
DTBPRDR .69160 2.3899 .28938[.775]
DUPRDR -12.6397 14.1568 -.89284[.380]
DTPRDR .52349 .41854 1.2508[.222]
PRDRATIO1 -.15455 .061974 -2.4938[.019]
DPRDR(-1) .096355 .16801 .57352[.571]
DPRDR(-2) -.17751 .15450 -1.1489[.261]
*******************************************************************************
R-Squared .72612 R-Bar-Squared .65512
S.E. of Regression 1.6614 F-stat. F( 7, 27) 10.2263[.000]
Mean of Dependent Variable -1.7629 S.D. of Dependent Variable 2.8290
Residual Sum of Squares 74.5224 Equation Log-likelihood -62.8885
Akaike Info. Criterion -70.8885 Schwarz Bayesian Criterion -77.1099
DW-statistic 2.0707
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= .57543[.448]*F( 1, 26)= .43461[.516]*
* * * *
* B:Functional Form *CHSQ( 1)= 4.2820[.039]*F( 1, 26)= 3.6243[.068]*
* * * *
* C:Normality *CHSQ( 2)= .53965[.764]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .60146[.438]*F( 1, 33)= .57701[.453]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Ordinary least squares estimation with 1 lag of the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is DPRDR
35 observations used for estimation from 1954 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 19.4596 10.1320 1.9206[.065]
TIM -.28293 .17139 -1.6508[.110]
DTBPRDR 1.5265 2.2897 .66666[.510]
DUPRDR -12.2661 14.2337 -.86176[.396]
DTPRDR .50094 .42046 1.1914[.243]
PRDRATIO1 -.14891 .062131 -2.3967[.023]
DPRDR(-1) .096472 .16896 .57096[.573]
*******************************************************************************
R-Squared .71273 R-Bar-Squared .65118
S.E. of Regression 1.6708 F-stat. F( 6, 28) 11.5784[.000]
Mean of Dependent Variable -1.7629 S.D. of Dependent Variable 2.8290
Residual Sum of Squares 78.1657 Equation Log-likelihood -63.7238
Akaike Info. Criterion -70.7238 Schwarz Bayesian Criterion -76.1675
DW-statistic 2.1026 Durbin's h-statistic -10.7571[.000]
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 2.0684[.150]*F( 1, 27)= 1.6959[.204]*
* * * *
* B:Functional Form *CHSQ( 1)= 11.7243[.001]*F( 1, 27)= 13.6002[.001]*
* * * *
```

```
* C:Normality *CHSQ( 2)= .69216[.707]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .52961[.467]*F( 1, 33)= .50702[.481]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Ordinary least squares estimation with 0 legs of the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is DPRDR
35 observations used for estimation from 1954 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 18.8827 9.9636 1.8952[.068]
TIM -.27056 .16803 -1.6102[.118]
DTBPRDR 1.1489 2.1665 .53028[.600]
DUPRDR -11.2199 13.9503 -.80428[.428]
DTPRDR .47994 .41395 1.1594[.256]
PRDRATIO1 -.14829 .061395 -2.4154[.022]
*******************************************************************************
R-Squared .70939 R-Bar-Squared .65928
S.E. of Regression 1.6513 F-stat. F( 5, 29) 14.1579[.000]
Mean of Dependent Variable -1.7629 S.D. of Dependent Variable 2.8290
Residual Sum of Squares 79.0758 Equation Log-likelihood -63.9264
Akaike Info. Criterion -69.9264 Schwarz Bayesian Criterion -74.5924
DW-statistic 1.9291
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= .0012621[.972]*F( 1, 28)= .0010097[.975]*
* * * *
* B:Functional Form *CHSQ( 1)= 10.1057[.001]*F( 1, 28)= 11.3664[.002]*
* * * *
* C:Normality *CHSQ( 2)= .45726[.796]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .38392[.536]*F( 1, 33)= .36599[.549]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

2a.) Testing down procedure for log level of the STDMER70 variable with 4 lag

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is DLER70
32 observations used for estimation from 1957 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 1.8300 .80259 2.2801[.033]
TIM -.0024476 .0056491 -.43327[.669]
DTBER70 -.068680 .068495 -1.0027[.327]
DUER70 .30047 .20980 1.4322[.166]
DTER70 -.018887 .011254 -1.6782[.107]
LER701 -.36944 .16157 -2.2866[.032]
DLER70(-1) .51150 .19599 2.6098[.016]
DLER70(-2) -.11649 .21944 -.53085[.601]
DLER70(-3) .42889 .23402 1.8327[.080]
DLER70(-4) .11051 .24129 .45798[.651]
*******************************************************************************
R-Squared .48380 R-Bar-Squared .27263
S.E. of Regression .058610 F-stat. F( 9, 22) 2.2911[.054]
Mean of Dependent Variable -.041334 S.D. of Dependent Variable .068722
Residual Sum of Squares .075572 Equation Log-likelihood 51.3684
Akaike Info. Criterion 41.3684 Schwarz Bayesian Criterion 34.0397
DW-statistic 1.7973
*******************************************************************************
Diagnostic Tests
*******************************************************************************
```

```
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 2.2209[.136]*F( 1, 21)= 1.5662[.225]*
* * * *
* B:Functional Form *CHSQ( 1)= 5.6897[.017]*F( 1, 21)= 4.5413[.045]*
* * * *
* C:Normality *CHSQ( 2)= .52757[.768]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= 6.4782[.011]*F( 1, 30)= 7.6149[.010]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

2. ADF Perron test for the log levels the variables of interest **STDMER70 PPP70 PRDRATIO**

Ordinary least squares estimation with 3 lags of the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is DLER70
32 observations used for estimation from 1957 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 1.6341 .66734 2.4487[.022]
TIM -.0022884 .0055407 -.41302[.683]
DTBER70 -.066373 .067126 -.98878[.333]
DUER70 .25383 .18024 1.4083[.172]
DTER70 -.016542 .0098489 -1.6796[.107]
LER701 -.32979 .13405 -2.4602[.022]
DLER70(-1) .50398 .19192 2.6261[.015]
DLER70(-2) -.15194 .20177 -.75302[.459]
DLER70(-3) .44975 .22557 1.9938[.058]
*******************************************************************************
R-Squared .47888 R-Bar-Squared .29763
S.E. of Regression .057594 F-stat. F( 8, 23) 2.6420[.033]
Mean of Dependent Variable -.041334 S.D. of Dependent Variable .068722
Residual Sum of Squares .076293 Equation Log-likelihood 51.2166
Akaike Info. Criterion 42.2166 Schwarz Bayesian Criterion 35.6208
DW-statistic 1.8502
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= .22690[.634]*F( 1, 22)= .15711[.696]*
* * * *
* B:Functional Form *CHSQ( 1)= 7.6109[.006]*F( 1, 22)= 6.8653[.016]*
* * * *
* C:Normality *CHSQ( 2)= .47708[.788]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= 7.9992[.005]*F( 1, 30)= 9.9987[.004]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Ordinary least squares estimation with 2 lags of the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is DLER70
32 observations used for estimation from 1957 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT .98048 .61626 1.5910[.125]
TIM -.0019750 .0058717 -.33636[.740]
DTBER70 -.041759 .069952 -.59697[.556]
```

```
DUER70 .066671 .16313 .40870[.686]
DTER70 -.0075880 .0092929 -.81654[.422]
LER701 -.19698 .12333 -1.5972[.123]
DLER70(-1) .40376 .19636 2.0562[.051]
DLER70(-2) -.098953 .21205 -.46665[.645]
******************************************************************************
R-Squared .38881 R-Bar-Squared .21055
S.E. of Regression .061060 F-stat. F( 7, 24) 2.1811[.073]
Mean of Dependent Variable -.041334 S.D. of Dependent Variable .068722
Residual Sum of Squares .089479 Equation Log-likelihood 48.6657
Akaike Info. Criterion 40.6657 Schwarz Bayesian Criterion 34.8027
DW-statistic 1.7454
******************************************************************************
Diagnostic Tests
******************************************************************************
* Test Statistics * LM Version * F Version *
******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 8.0622[.005]*F( 1, 23)= 7.7463[.011]*
* * * *
* B:Functional Form *CHSQ( 1)= 13.3134[.000]*F( 1, 23)= 16.3866[.000]*
* * * *
* C:Normality *CHSQ( 2)= 1.2192[.544]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= 1.2298[.267]*F( 1, 30)= 1.1990[.282]*
******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

2b) Testing down procedure **ADF -Peronn procedure** for log level of PPP70 VARIABLE

```
Ordinary Least Squares Estimation
******************************************************************************
Dependent variable is DLPPP70
34 observations used for estimation from 1955 to 1988
******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 1.7067 .49789 3.4278[.002]
TIM -.0050941 .0014773 -3.4482[.002]
DTBPPP70 .053215 .026867 1.9807[.059]
DUPPP70 .16015 .15505 1.0329[.312]
DTPPP70 -.011451 .0061625 -1.8583[.075]
LPPP701 -.34722 .10084 -3.4432[.002]
DLPPP70(-1) .28581 .16572 1.7246[.097]
DLPPP70(-2) .085366 .16737 .51004[.615]
DLPPP70(-3) .052515 .14819 .35437[.726]
DLPPP70(-4) .24413 .14926 1.6356[.115]
******************************************************************************
R-Squared .85910 R-Bar-Squared .80626
S.E. of Regression .017156 F-stat. F( 9, 24) 16.2590[.000]
Mean of Dependent Variable -.037798 S.D. of Dependent Variable .038976
Residual Sum of Squares .0070636 Equation Log-likelihood 95.9018
Akaike Info. Criterion 85.9018 Schwarz Bayesian Criterion 78.2700
DW-statistic 2.0971
******************************************************************************
Diagnostic Tests
******************************************************************************
* Test Statistics * LM Version * F Version *
******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= .82485[.364]*F( 1, 23)= .57186[.457]*
* * * *
* B:Functional Form *CHSQ( 1)= .050150[.823]*F( 1, 23)= .033975[.855]*
* * * *
* C:Normality *CHSQ( 2)= 6.1368[.046]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= 1.5656[.211]*F( 1, 32)= 1.5446[.223]*
******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

```
Ordinary least squares estimation with 3 lags of the dependent variable
Ordinary Least Squares Estimation
******************************************************************************
Dependent variable is DLPPP70
34 observations used for estimation from 1955 to 1988
******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 1.2101 .40761 2.9687[.007]
TIM -.0037831 .0012819 -2.9512[.007]
DTBPPP70 .059581 .027460 2.1698[.040]
DUPPP70 .0046913 .12654 .037072[.971]
DTPPP70 -.0053483 .0050661 -1.0557[.301]
LPPP701 -.24709 .082777 -2.9850[.006]
DLPPP70(-1) .23243 .16783 1.3849[.178]
DLPPP70(-2) -.019878 .15960 -.12455[.902]
DLPPP70(-3) .12456 .14616 .85221[.402]
******************************************************************************
R-Squared .84339 R-Bar-Squared .79328
S.E. of Regression .017721 F-stat. F( 8, 25) 16.8292[.000]
Mean of Dependent Variable -.037798 S.D. of Dependent Variable .038976
Residual Sum of Squares .0078510 Equation Log-likelihood 94.1052
Akaike Info. Criterion 85.1052 Schwarz Bayesian Criterion 78.2366
DW-statistic 1.8195
******************************************************************************
Diagnostic Tests
******************************************************************************
* Test Statistics * LM Version * F Version *
******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= .93351[.334]*F( 1, 24)= .67755[.419]*
* * * *
* B:Functional Form *CHSQ( 1)= .24450[.621]*F( 1, 24)= .17384[.680]*
* * * *
* C:Normality *CHSQ( 2)= 3.9430[.139]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= 2.4645[.116]*F( 1, 32)= 2.5008[.124]*
******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Ordinary east squares estimation with 2 lags of the dependent variable

```
Ordinary Least Squares Estimation
******************************************************************************
Dependent variable is DLPPP70
36 observations used for estimation from 1953 to 1988
******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 1.0414 .33284 3.1290[.004]
TIM -.0030687 .0010680 -2.8734[.008]
DTBPPP70 .054547 .026018 2.0965[.045]
DUPPP70 -.027936 .097808 -.28562[.777]
DTPPP70 -.0039742 .0039746 -.99989[.326]
LPPP701 -.21395 .067659 -3.1621[.004]
DLPPP70(-1) .25941 .14392 1.8024[.082]
DLPPP70(-2) .0063447 .13787 .046020[.964]
******************************************************************************
R-Squared .83500 R-Bar-Squared .79375
S.E. of Regression .017281 F-stat. F( 7, 28) 20.2430[.000]
Mean of Dependent Variable -.037435 S.D. of Dependent Variable .038052
Residual Sum of Squares .0083616 Equation Log-likelihood 99.5354
Akaike Info. Criterion 91.5354 Schwarz Bayesian Criterion 85.2013
DW-statistic 1.8940
******************************************************************************
Diagnostic Tests
******************************************************************************
* Test Statistics * LM Version * F Version *
******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= .26244[.608]*F( 1, 27)= .19827[.660]*
* * * *
* B:Functional Form *CHSQ( 1)= .98212[.322]*F( 1, 27)= .75725[.392]*
```

```
* * * *
* C:Normality *CHSQ( 2)= 5.0086[.082]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= 2.0038[.157]*F( 1, 34)= 2.0040[.166]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Ordinary least squares estimation with 1 lag of the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is DLPPP70
36 observations used for estimation from 1953 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 1.0331 .27489 3.7584[.001]
TIM -.0030466 .9370E-3 -3.2514[.003]
DTBPPP70 .054608 .025533 2.1387[.041]
DUPPP70 -.030375 .080782 -.37601[.710]
DTPPP70 -.0038745 .0032747 -1.1832[.246]
LPPP701 -.21227 .056037 -3.7880[.001]
DLPPP70(-1) .26172 .13256 1.9743[.058]
*******************************************************************************
R-Squared .83499 R-Bar-Squared .80085
S.E. of Regression .016981 F-stat. F( 6, 29) 24.4580[.000]
Mean of Dependent Variable -.037435 S.D. of Dependent Variable .038052
Residual Sum of Squares .0083623 Equation Log-likelihood 99.5340
Akaike Info. Criterion 92.5340 Schwarz Bayesian Criterion 86.9917
DW-statistic 1.8989 Durbin's h-statistic .50032[.617]
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= .12767[.721]*F( 1, 28)= .099652[.755]*
* * * *
* B:Functional Form *CHSQ( 1)= .93584[.333]*F( 1, 28)= .74731[.395]*
* * * *
* C:Normality *CHSQ( 2)= 4.7075[.095]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= 2.0393[.153]*F( 1, 34)= 2.0417[.162]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

2c) Testing down procedure **ADF -Peronn procedure** for log level of PRDRATIO VARIABLE

Ordinary least squares estimation with 4 lags of the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is DLPRDR
34 observations used for estimation from 1955 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT .18510 .11441 1.6178[.119]
TIM -.0030408 .0018821 -1.6157[.119]
DTBPRDR .010108 .026100 .38726[.702]
DUPRDR -.10380 .16171 -.64186[.527]
DTPRDR .0048474 .0047921 1.0115[.322]
PRDRATIO1 -.0013872 .7062E-3 -1.9643[.061]
DLPRDR(-1) .050646 .18943 .26736[.791]
DLPRDR(-2) -.13849 .18721 -.73977[.467]
DLPRDR(-3) .028232 .16832 .16773[.868]
DLPRDR(-4) -.020318 .18447 -.11014[.913]
*******************************************************************************
R-Squared .69980 R-Bar-Squared .58723
S.E. of Regression .017030 F-stat. F( 9, 24) 6.2163[.000]
```

```
Mean of Dependent Variable -.013695 S.D. of Dependent Variable .026507
Residual Sum of Squares .0069604 Equation Log-likelihood 96.1519
Akaike Info. Criterion 86.1519 Schwarz Bayesian Criterion 78.5201
DW-statistic 2.0592
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 1.8696[.172]*F( 1, 23)= 1.3383[.259]*
* * * *
* B:Functional Form *CHSQ( 1)= 6.4130[.011]*F( 1, 23)= 5.3467[.030]*
* * * *
* C:Normality *CHSQ( 2)= .30143[.860]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= 1.2221[.269]*F( 1, 32)= 1.1931[.283]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Ordinary least squares estimation with three lags of the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is DLPRDR
34 observations used for estimation from 1955 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT .18577 .11197 1.6591[.110]
TIM -.0030565 .0018392 -1.6619[.109]
DTBPRDR .010399 .025447 .40866[.686]
DUPRDR -.097829 .14933 -.65514[.518]
DTPRDR .0046697 .0044223 1.0559[.301]
PRDRATIO1 -.0013856 .6919E-3 -2.0024[.056]
DLPRDR(-1) .050177 .18560 .27035[.789]
DLPRDR(-2) -.13244 .17541 -.75505[.457]
DLPRDR(-3) .024133 .16087 .15001[.882]
*******************************************************************************
R-Squared .69965 R-Bar-Squared .60354
S.E. of Regression .016690 F-stat. F( 8, 25) 7.2795[.000]
Mean of Dependent Variable -.013695 S.D. of Dependent Variable .026507
Residual Sum of Squares .0069640 Equation Log-likelihood 96.1433
Akaike Info. Criterion 87.1433 Schwarz Bayesian Criterion 80.2747
DW-statistic 2.0655
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 2.1121[.146]*F( 1, 24)= 1.5896[.220]*
* * * *
* B:Functional Form *CHSQ( 1)= 5.8282[.016]*F( 1, 24)= 4.9652[.035]*
* * * *
* C:Normality *CHSQ( 2)= .28995[.865]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= 1.0579[.304]*F( 1, 32)= 1.0277[.318]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Ordinary least squares estimation with 3 lags of the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is DLPRDR
34 observations used for estimation from 1955 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 1.2362 .56523 2.1872[.038]
```

```
TIM -.0051544 .0025541 -2.0181[.054]
DTBPRDR .012237 .025005 .48939[.629]
DUPRDR -.24130 .18581 -1.2986[.206]
DTPRDR .0089231 .0055562 1.6060[.121]
LPRDR1 -.24716 .10972 -2.2528[.033]
DLPRDR(-1) .12642 .18595 .67986[.503]
DLPRDR(-2) -.089448 .17546 -.50978[.615]
DLPRDR(-3) .067750 .15844 .42761[.673]
*******************************************************************************
R-Squared .71029 R-Bar-Squared .61758
S.E. of Regression .016392 F-stat. F( 8, 25) 7.6616[.000]
Mean of Dependent Variable -.013695 S.D. of Dependent Variable .026507
Residual Sum of Squares .0067173 Equation Log-likelihood 96.7564
Akaike Info. Criterion 87.7564 Schwarz Bayesian Criterion 80.8878
DW-statistic 2.0706
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 2.0538[.152]*F( 1, 24)= 1.5429[.226]*
* * * *
* B:Functional Form *CHSQ( 1)= 5.9912[.014]*F( 1, 24)= 5.1337[.033]*
* * * *
* C:Normality *CHSQ( 2)= .41748[.812]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= 1.2117[.271]*F( 1, 32)= 1.1826[.285]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Ordinary least squares estimation with 2 lags of the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is DLPRDR
34 observations used for estimation from 1955 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 1.2129 .55367 2.1906[.038]
TIM -.0050146 .0024930 -2.0115[.055]
DTBPRDR .011754 .024584 .47810[.637]
DUPRDR -.24376 .18278 -1.3336[.194]
DTPRDR .0090246 .0054632 1.6519[.111]
LPRDR1 -.24318 .10759 -2.2603[.032]
DLPRDR(-1) .10689 .17739 .60254[.552]
DLPRDR(-2) -.082127 .17186 -.47787[.637]
*******************************************************************************
R-Squared .70817 R-Bar-Squared .62960
S.E. of Regression .016132 F-stat. F( 7, 26) 9.0133[.000]
Mean of Dependent Variable -.013695 S.D. of Dependent Variable .026507
Residual Sum of Squares .0067664 Equation Log-likelihood 96.6326
Akaike Info. Criterion 88.6326 Schwarz Bayesian Criterion 82.5271
DW-statistic 2.0333
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= .46668[.495]*F( 1, 25)= .34792[.561]*
* * * *
* B:Functional Form *CHSQ( 1)= 6.3048[.012]*F( 1, 25)= 5.6912[.025]*
* * * *
* C:Normality *CHSQ( 2)= .52050[.771]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= 1.5664[.211]*F( 1, 32)= 1.5455[.223]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Ordinary least squares estimation with 1 lag of the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is DLPRDR
34 observations used for estimation from 1955 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 1.2808 .52743 2.4283[.022]
TIM -.0053432 .0023618 -2.2623[.032]
DTBPRDR .016131 .022485 .71742[.479]
DUPRDR -.26058 .17678 -1.4740[.152]
DTPRDR .0094778 .0053028 1.7873[.085]
LPRDR1 -.25587 .10276 -2.4900[.019]
DLPRDR(-1) .11110 .17463 .63619[.530]
*******************************************************************************
R-Squared .70561 R-Bar-Squared .64019
S.E. of Regression .015900 F-stat. F( 6, 27) 10.7857[.000]
Mean of Dependent Variable -.013695 S.D. of Dependent Variable .026507
Residual Sum of Squares .0068258 Equation Log-likelihood 96.4839
Akaike Info. Criterion 89.4839 Schwarz Bayesian Criterion 84.1416
DW-statistic 2.0509 Durbin's h-statistic *NONE*
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= .84323[.358]*F( 1, 26)= .66122[.424]*
* * * *
* B:Functional Form *CHSQ( 1)= 7.6533[.006]*F( 1, 26)= 7.5526[.011]*
* * * *
* C:Normality *CHSQ( 2)= .38578[.825]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= 2.2659[.132]*F( 1, 32)= 2.2848[.140]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Ordinary least equares estimation with 0 lags of the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is DLPRDR
34 observations used for estimation from 1955 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 1.2178 .51253 2.3761[.025]
TIM -.0050393 .0022883 -2.2022[.036]
DTBPRDR .011084 .020814 .53253[.599]
DUPRDR -.23262 .16940 -1.3732[.181]
DTPRDR .0087745 .0051309 1.7101[.098]
LPRDR1 -.24429 .10005 -2.4416[.021]
*******************************************************************************
R-Squared .70119 R-Bar-Squared .64784
S.E. of Regression .015730 F-stat. F( 5, 28) 13.1412[.000]
Mean of Dependent Variable -.013695 S.D. of Dependent Variable .026507
Residual Sum of Squares .0069282 Equation Log-likelihood 96.2310
Akaike Info. Criterion 90.2310 Schwarz Bayesian Criterion 85.6519
DW-statistic 1.8708
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= .12892[.720]*F( 1, 27)= .10277[.751]*
* * * *
* B:Functional Form *CHSQ( 1)= 5.8348[.016]*F( 1, 27)= 5.5934[.025]*
* * * *
* C:Normality *CHSQ( 2)= .42348[.809]* Not applicable *
* * * *
```

```
* D:Heteroscedasticity*CHSQ( 1)= 2.0489[.152]*F( 1, 32)= 2.0520[.162]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

1a.) Testing down procedure for 1st difference of the STDMER70 variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is D2ER70
33 observations used for estimation from 1956 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 24.2508 15.4501 1.5696[.130]
TIM -.18665 .38802 -.48102[.635]
DTBER70 -12.2869 5.5575 -2.2109[.037]
DUER70 8.2353 8.1499 1.0105[.322]
DTER70 -.52585 .52764 -.99661[.329]
STDMER701 -.16913 .10425 -1.6223[.118]
D2ER70(-1) -.44599 .15491 -2.8791[.008]
D2ER70(-3) .020472 .17588 .11640[.908]
D2ER70(-4) -.10053 .17330 -.58007[.567]
*******************************************************************************
R-Squared .45720 R-Bar-Squared .27626
S.E. of Regression 4.5405 F-stat. F( 8, 24) 2.5269[.038]
Mean of Dependent Variable .060606 S.D. of Dependent Variable 5.3372
Residual Sum of Squares 494.7851 Equation Log-likelihood -91.5006
Akaike Info. Criterion -100.5006 Schwarz Bayesian Criterion -107.2349
DW-statistic 1.8250
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= .11430[.735]*F( 1, 23)= .079941[.780]*
* * * *
* B:Functional Form *CHSQ( 1)= 4.0897[.043]*F( 1, 23)= 3.2536[.084]*
* * * *
* C:Normality *CHSQ( 2)= 1.7399[.419]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .15453[.694]*F( 1, 31)= .14585[.705]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

2. ADF PERRON test for the 1st differences the variables of interest STDMER70 PPP70 PRDRATIO

Ordinary least squares estimation with 2 lags of the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is D2ER70
34 observations used for estimation from 1955 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 23.8194 14.6657 1.6242[.116]
TIM -.18182 .33351 -.54516[.590]
DTBER70 -12.5022 5.3649 -2.3304[.028]
DUER70 8.6378 7.5265 1.1477[.262]
DTER70 -.53547 .48481 -1.1045[.280]
STDMER701 -.16638 .10073 -1.6518[.111]
D2ER70(-1) -.44887 .14969 -2.9987[.006]
D2ER70(-2) .061980 .15477 .40046[.692]
*******************************************************************************
R-Squared .44957 R-Bar-Squared .30138
S.E. of Regression 4.3929 F-stat. F( 7, 26) 3.0337[.018]
Mean of Dependent Variable .058824 S.D. of Dependent Variable 5.2557
Residual Sum of Squares 501.7385 Equation Log-likelihood -94.0031
Akaike Info. Criterion -102.0031 Schwarz Bayesian Criterion -108.1086
DW-statistic 1.8224
```

```
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= .14418[.704]*F( 1, 25)= .10646[.747]*
* * * *
* B:Functional Form *CHSQ( 1)= 5.1454[.023]*F( 1, 25)= 4.4580[.045]*
* * * *
* C:Normality *CHSQ( 2)= 5.3261[.070]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .093109[.760]*F( 1, 32)= .087873[.769]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Ordinary least squares estimation with 1 lag of the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is D2ER70
34 observations used for estimation from 1955 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 24.4443 14.3540 1.7030[.100]
TIM -.18690 .32805 -.56974[.574]
DTBER70 -12.2026 5.2292 -2.3336[.027]
DUER70 8.5044 7.4012 1.1491[.261]
DTER70 -.53807 .47717 -1.1276[.269]
STDMER701 -.17067 .098583 -1.7312[.095]
D2ER70(-1) -.45407 .14679 -3.0933[.005]
*******************************************************************************
R-Squared .44618 R-Bar-Squared .32310
S.E. of Regression 4.3241 F-stat. F( 6, 27) 3.6253[.009]
Mean of Dependent Variable .058824 S.D. of Dependent Variable 5.2557
Residual Sum of Squares 504.8333 Equation Log-likelihood -94.1077
Akaike Info. Criterion -101.1077 Schwarz Bayesian Criterion -106.4499
DW-statistic 1.8948 Durbin's h-statistic .59303[.553]
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= .0046474[.946]*F( 1, 26)= .0035544[.953]*
* * * *
* B:Functional Form *CHSQ( 1)= 5.5845[.018]*F( 1, 26)= 5.1097[.032]*
* * * *
* C:Normality *CHSQ( 2)= 6.7289[.035]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .058710[.809]*F( 1, 32)= .055352[.815]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

1b.) Testing down procedure for 1st diference of level form of PPP70

```
Ordinary least squares estimation with 4 lags for the dependent variable
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is D2PPP70
33 observations used for estimation from 1956 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 63.7120 8.0135 7.9506[.000]
TIM -.79701 .10304 -7.7353[.000]
DTBPPP70 5.0670 1.8595 2.7249[.012]
DUPPP70 1.4498 3.0118 .48136[.635]
DTPPP70 -.47123 .13588 -3.4680[.002]
PPP701 -.46230 .059751 -7.7371[.000]
```

```
D2PPP70(-1) -.71175 .12230 -5.8195[.000]
D2PPP70(-2) -.63588 .11626 -5.4695[.000]
D2PPP70(-3) -.44658 .098857 -4.5175[.000]
D2PPP70(-4) -.29015 .088324 -3.2851[.003]
*******************************************************************************
R-Squared .80509 R-Bar-Squared .72882
S.E. of Regression 1.1065 F-stat. F( 9, 23) 10.5560[.000]
Mean of Dependent Variable .081818 S.D. of Dependent Variable 2.1249
Residual Sum of Squares 28.1622 Equation Log-likelihood -44.2093
Akaike Info. Criterion -54.2093 Schwarz Bayesian Criterion -61.6918
DW-statistic 2.2244
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 1.7227[.189]*F( 1, 22)= 1.2117[.283]*
* * * *
* B:Functional Form *CHSQ( 1)= .033006[.856]*F( 1, 22)= .022026[.883]*
* * * *
* C:Normality *CHSQ( 2)= .87256[.646]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .041462[.839]*F( 1, 31)= .038999[.845]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Ordinary least squares estimation with 3 lags of the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is D2PPP70
34 observations used for estimation from 1955 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 57.8637 9.1779 6.3047[.000]
TIM -.67837 .11601 -5.8474[.000]
DTBPPP70 3.2850 2.0657 1.5903[.124]
DUPPP70 4.6749 3.4098 1.3710[.183]
DTPPP70 -.56645 .15514 -3.6511[.001]
PPP701 -.42685 .068380 -6.2424[.000]
D2PPP70(-1) -.63921 .13880 -4.6051[.000]
D2PPP70(-2) -.46118 .11856 -3.8899[.001]
D2PPP70(-3) -.30748 .10343 -2.9728[.006]
*******************************************************************************
R-Squared .70771 R-Bar-Squared .61418
S.E. of Regression 1.3185 F-stat. F( 8, 25) 7.5665[.000]
Mean of Dependent Variable .020588 S.D. of Dependent Variable 2.1227
Residual Sum of Squares 43.4622 Equation Log-likelihood -52.4179
Akaike Info. Criterion -61.4179 Schwarz Bayesian Criterion -68.2865
DW-statistic 1.9789
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= .045363[.831]*F( 1, 24)= .032064[.859]*
* * * *
* B:Functional Form *CHSQ( 1)= .028254[.867]*F( 1, 24)= .019961[.889]*
* * * *
* C:Normality *CHSQ( 2)= .66414[.717]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .34805[.555]*F( 1, 32)= .33096[.569]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Ordinary least squares estimation with 2 lags of the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is D2PPP70
34 observations used for estimation from 1955 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 48.4494 9.8272 4.9301[.000]
TIM -.55923 .12420 -4.5027[.000]
DTBPPP70 1.8418 2.2905 .80410[.429]
DUPPP70 5.5856 3.8742 1.4418[.161]
DTPPP70 -.53180 .17649 -3.0132[.006]
PPP701 -.35873 .073498 -4.8808[.000]
D2PPP70(-1) -.43635 .13789 -3.1645[.004]
D2PPP70(-2) -.36648 .13028 -2.8131[.009]
*******************************************************************************
R-Squared .60439 R-Bar-Squared .49787
S.E. of Regression 1.5042 F-stat. F( 7, 26) 5.6744[.000]
Mean of Dependent Variable .020588 S.D. of Dependent Variable 2.1227
Residual Sum of Squares 58.8261 Equation Log-likelihood -57.5637
Akaike Info. Criterion -65.5637 Schwarz Bayesian Criterion -71.6692
DW-statistic 2.0809
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= .35418[.552]*F( 1, 25)= .26317[.612]*
* * * *
* B:Functional Form *CHSQ( 1)= .090045[.764]*F( 1, 25)= .066386[.799]*
* * * *
* C:Normality *CHSQ( 2)= 6.8854[.032]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .13932[.709]*F( 1, 32)= .13166[.719]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Ordinary least squares estimation with 1 lag of the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is D2PPP70
36 observations used for estimation from 1953 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 36.7019 11.3100 3.2451[.003]
TIM -.46222 .13578 -3.4043[.002]
DTBPPP70 -1.1792 2.5900 -.45529[.652]
DUPPP70 5.0324 4.5782 1.0992[.281]
DTPPP70 -.39643 .20804 -1.9056[.067]
PPP701 -.26495 .085138 -3.1120[.004]
D2PPP70(-1) -.32019 .14295 -2.2399[.033]
*******************************************************************************
R-Squared .42412 R-Bar-Squared .30497
S.E. of Regression 1.8485 F-stat. F( 6, 29) 3.5596[.009]
Mean of Dependent Variable .21389 S.D. of Dependent Variable 2.2172
Residual Sum of Squares 99.0877 Equation Log-likelihood -69.3065
Akaike Info. Criterion -76.3065 Schwarz Bayesian Criterion -81.8489
DW-statistic 2.1284 Durbin's h-statistic -.74913[.454]
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= .66160[.416]*F( 1, 28)= .52421[.475]*
* * * *
* B:Functional Form *CHSQ( 1)= 1.3452[.246]*F( 1, 28)= 1.0869[.306]*
* * * *
```

```
* C:Normality *CHSQ( 2)= .72787[.695]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .40126[.526]*F( 1, 34)= .38324[.540]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

1c. Testing down procedure for the 1st difference of the level form of dependent variable PRDRATIO

Ordinary least squares estimation with 4 lags of the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is D2PRDR
33 observations used for estimation from 1956 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 32.8943 13.9188 2.3633[.027]
TIM -.53984 .22211 -2.4305[.023]
DTBPRDR 1.8624 2.6565 .70107[.490]
DUPRDR -5.4202 18.6484 -.29065[.774]
DTPRDR .31072 .54873 .56626[.577]
PRDRATIO1 -.20162 .088592 -2.2758[.032]
D2PRDR(-1) -.75139 .17827 -4.2150[.000]
D2PRDR(-2) -.73150 .20494 -3.5694[.002]
D2PRDR(-3) -.41061 .19478 -2.1081[.046]
D2PRDR(-4) -.23720 .16991 -1.3961[.176]
*******************************************************************************
R-Squared .58970 R-Bar-Squared .42914
S.E. of Regression 1.8779 F-stat. F( 9, 23) 3.6729[.006]
Mean of Dependent Variable .17576 S.D. of Dependent Variable 2.4855
Residual Sum of Squares 81.1090 Equation Log-likelihood -61.6632
Akaike Info. Criterion -71.6632 Schwarz Bayesian Criterion -79.1457
DW-statistic 2.1926
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 2.8189[.093]*F( 1, 22)= 2.0548[.166]*
* * * *
* B:Functional Form *CHSQ( 1)= 1.6677[.197]*F( 1, 22)= 1.1709[.291]*
* * * *
* C:Normality *CHSQ( 2)= .14080[.932]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .098586[.754]*F( 1, 31)= .092889[.763]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values

Ordinary least squares estimation with 3 lags of the dependent variable
*******************************************************
Dependent variable is D2PRDR
34 observations used for estimation from 1955 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 24.9434 13.1287 1.8999[.069]
TIM -.41717 .21517 -1.9388[.064]
DTBPRDR 3.3346 2.6656 1.2510[.223]
DUPRDR -7.2515 18.2082 -.39826[.694]
DTPRDR .31917 .53762 .59366[.558]
PRDRATIO1 -.15098 .082320 -1.8341[.079]
D2PRDR(-1) -.64194 .17533 -3.6613[.001]
D2PRDR(-2) -.47964 .16708 -2.8707[.008]
D2PRDR(-3) -.24201 .16939 -1.4287[.165]
*******************************************************************************
R-Squared .51515 R-Bar-Squared .36000
S.E. of Regression 1.9646 F-stat. F( 8, 25) 3.3203[.010]
Mean of Dependent Variable .14118 S.D. of Dependent Variable 2.4558
Residual Sum of Squares 96.4952 Equation Log-likelihood -65.9772
```

```
Akaike Info. Criterion -74.9772 Schwarz Bayesian Criterion -81.8458
DW-statistic 2.2757
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 5.0493[.025]*F( 1, 24)= 4.1858[.052]*
* * * *
* B:Functional Form *CHSQ( 1)= 3.2561[.071]*F( 1, 24)= 2.5419[.124]*
* * * *
* C:Normality *CHSQ( 2)= .37553[.829]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .4951E-3[.982]*F( 1, 32)= .4659E-3[.983]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Ordinary leastsquares estimation with 2 lags of the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is D2PRDR
34 observations used for estimation from 1955 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 26.6311 13.3347 1.9971[.056]
TIM -.43373 .21912 -1.9794[.058]
DTBPRDR 3.7843 2.6994 1.4019[.173]
DUPRDR -14.6509 17.8023 -.82298[.418]
DTPRDR .52107 .52901 .98499[.334]
PRDRATIO1 -.16407 .083431 -1.9666[.060]
D2PRDR(-1) -.52114 .15664 -3.3269[.003]
D2PRDR(-2) -.36046 .14764 -2.4415[.022]
*******************************************************************************
R-Squared .47557 R-Bar-Squared .33437
S.E. of Regression 2.0036 F-stat. F( 7, 26) 3.3682[.011]
Mean of Dependent Variable .14118 S.D. of Dependent Variable 2.4558
Residual Sum of Squares 104.3740 Equation Log-likelihood -67.3115
Akaike Info. Criterion -75.3115 Schwarz Bayesian Criterion -81.4169
DW-statistic 2.3533
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 4.7475[.029]*F( 1, 25)= 4.0573[.055]*
* * * *
* B:Functional Form *CHSQ( 1)= .83879[.360]*F( 1, 25)= .63235[.434]*
* * * *
* C:Normality *CHSQ( 2)= .59873[.741]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .0061236[.938]*F( 1, 32)= .0057644[.940]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Ordinary least squares estimation with 1 lag of the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is D2PRDR
31 observations used for estimation from 1958 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 53.2829 21.8677 2.4366[.023]
TIM -.79867 .32803 -2.4348[.023]
DTBPRDR 4.8963 2.9273 1.6726[.107]
DUPRDR -41.6577 23.4248 -1.7784[.088]
```

```
DTPRDR 1.3388 .71014 1.8853[.072]
PRDRATIO1 -.34600 .14358 -2.4098[.024]
D2PRDR(-1) -.38273 .16500 -2.3196[.029]
*******************************************************************************
R-Squared .40133 R-Bar-Squared .25167
S.E. of Regression 2.2202 F-stat. F( 6, 24) 2.6815[.039]
Mean of Dependent Variable .18710 S.D. of Dependent Variable 2.5665
Residual Sum of Squares 118.3055 Equation Log-likelihood -64.7460
Akaike Info. Criterion -71.7460 Schwarz Bayesian Criterion -76.7649
DW-statistic 2.2122 Durbin's h-statistic -1.4952[.135]
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 2.3789[.123]*F( 1, 23)= 1.9117[.180]*
* * * *
* B:Functional Form *CHSQ( 1)= .36536[.546]*F( 1, 23)= .27430[.605]*
* * * *
* C:Normality *CHSQ( 2)= .094843[.954]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .0037195[.951]*F( 1, 29)= .0034799[.953]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

3.ADF Perron Test for log of the 1st differences of the variables of interest

3a) Testing down procedure for 1st difference of the log level of STDMER70 variable of interest

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is D2LER70
33 observations used for estimation from 1956 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 1.9116 .51596 3.7050[.001]
TIM -.0024261 .0047913 -.50636[.617]
DTBER70 -.069792 .064558 -1.0811[.291]
DUER70 .31854 .12785 2.4915[.020]
DTER70 -.019865 .0076425 -2.5993[.016]
LER701 -.38619 .10357 -3.7286[.001]
D2LER70(-1) -.48093 .16415 -2.9299[.008]
D2LER70(-2) -.61246 .17220 -3.5566[.002]
D2LER70(-3) -.16472 .18801 -.87609[.390]
D2LER70(-4) -.11575 .17960 -.64451[.526]
*******************************************************************************
R-Squared .57343 R-Bar-Squared .40651
S.E. of Regression .056838 F-stat. F( 9, 23) 3.4353[.008]
Mean of Dependent Variable .0017471 S.D. of Dependent Variable .073778
Residual Sum of Squares .074302 Equation Log-likelihood 53.7611
Akaike Info. Criterion 43.7611 Schwarz Bayesian Criterion 36.2785
DW-statistic 1.7688
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 3.4948[.062]*F( 1, 22)= 2.6058[.121]*
* * * *
* B:Functional Form *CHSQ( 1)= 3.6649[.056]*F( 1, 22)= 2.7485[.112]*
* * * *
* C:Normality *CHSQ( 2)= .46447[.793]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= 1.2502[.264]*F( 1, 31)= 1.2207[.278]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Ordinary least squares estimation with 3 lags for the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is D2LER70
33 observations used for estimation from 1956 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 1.9148 .50961 3.7573[.001]
TIM -.0024617 .0047323 -.52020[.608]
DTBER70 -.071016 .063739 -1.1142[.276]
DUER70 .32399 .12601 2.5711[.017]
DTER70 -.020027 .0075447 -2.6545[.014]
LER701 -.38676 .10230 -3.7806[.001]
D2LER70(-1) -.47425 .16181 -2.9309[.007]
D2LER70(-2) -.57540 .16033 -3.5889[.001]
D2LER70(-3) -.13223 .17891 -.73909[.467]
*******************************************************************************
R-Squared .56572 R-Bar-Squared .42096
S.E. of Regression .056141 F-stat. F( 8, 24) 3.9080[.004]
Mean of Dependent Variable .0017471 S.D. of Dependent Variable .073778
Residual Sum of Squares .075644 Equation Log-likelihood 53.4657
Akaike Info. Criterion 44.4657 Schwarz Bayesian Criterion 37.7314
DW-statistic 1.7929
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 1.9946[.158]*F( 1, 23)= 1.4796[.236]*
* * * *
* B:Functional Form *CHSQ( 1)= 3.4984[.061]*F( 1, 23)= 2.7274[.112]*
* * * *
* C:Normality *CHSQ( 2)= .47431[.789]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .85047[.356]*F( 1, 31)= .82006[.372]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Ordinary least squares estimation with 2 lags for the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is D2LER70
35 observations used for estimation from 1954 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 1.8665 .47969 3.8910[.001]
TIM -.0022256 .0035821 -.62132[.540]
DTBER70 -.075812 .060499 -1.2531[.221]
DUER70 .32533 .11476 2.8348[.009]
DTER70 -.019926 .0067199 -2.9653[.006]
LER701 -.37753 .096843 -3.8984[.001]
D2LER70(-1) -.43225 .14428 -2.9960[.006]
D2LER70(-2) -.54044 .14641 -3.6912[.001]
*******************************************************************************
R-Squared .55536 R-Bar-Squared .44008
S.E. of Regression .053564 F-stat. F( 7, 27) 4.8176[.001]
Mean of Dependent Variable .0018597 S.D. of Dependent Variable .071583
Residual Sum of Squares .077464 Equation Log-likelihood 57.3196
Akaike Info. Criterion 49.3196 Schwarz Bayesian Criterion 43.0982
DW-statistic 1.8795
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
```

```
* A:Serial Correlation*CHSQ( 1)= .021487[.883]*F( 1, 26)= .015971[.900]*
* * * *
* B:Functional Form *CHSQ( 1)= 3.1013[.078]*F( 1, 26)= 2.5278[.124]*
* * * *
* C:Normality *CHSQ( 2)= .52178[.770]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= 2.6467[.104]*F( 1, 33)= 2.6996[.110]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Ordinary least squares estimation with 1lag of the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is D2LER70
35 observations used for estimation from 1954 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 1.7135 .57564 2.9766[.006]
TIM -.0022717 .0043147 -.52650[.603]
DTBER70 -.073360 .072868 -1.0068[.323]
DUER70 .28944 .13774 2.1014[.045]
DTER70 -.017628 .0080595 -2.1872[.037]
LER701 -.34617 .11620 -2.9790[.006]
D2LER70(-1) -.28183 .16671 -1.6906[.102]
*******************************************************************************
R-Squared .33098 R-Bar-Squared .18762
S.E. of Regression .064519 F-stat. F( 6, 28) 2.3087[.062]
Mean of Dependent Variable .0018597 S.D. of Dependent Variable .071583
Residual Sum of Squares .11656 Equation Log-likelihood 50.1700
Akaike Info. Criterion 43.1700 Schwarz Bayesian Criterion 37.7263
DW-statistic 1.7833 Durbin's h-statistic 3.8804[.000]
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= .023465[.878]*F( 1, 27)= .018114[.894]*
* * * *
* B:Functional Form *CHSQ( 1)= 1.2220[.269]*F( 1, 27)= .97676[.332]*
* * * *
* C:Normality *CHSQ( 2)= 1.8473[.397]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .58358[.445]*F( 1, 33)= .55957[.460]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Ordinary least squares estimation with 0 lags of the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is D2LER70
37 observations used for estimation from 1952 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 1.5352 .56377 2.7231[.011]
TIM -.0018741 .0035304 -.53084[.599]
DTBER70 -.073463 .072821 -1.0088[.321]
DUER70 .26506 .13322 1.9896[.056]
DTER70 -.016016 .0076436 -2.0954[.044]
LER701 -.31070 .11416 -2.7215[.011]
*******************************************************************************
R-Squared .26213 R-Bar-Squared .14311
S.E. of Regression .064479 F-stat. F( 5, 31) 2.2025[.079]
Mean of Dependent Variable .0017591 S.D. of Dependent Variable .069655
Residual Sum of Squares .12888 Equation Log-likelihood 52.2051
```

```
Akaike Info. Criterion 46.2051 Schwarz Bayesian Criterion 41.3723
DW-statistic 2.0796
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= .50342[.478]*F( 1, 30)= .41381[.525]*
* * * *
* B:Functional Form *CHSQ( 1)= 4.8855[.027]*F( 1, 30)= 4.5638[.041]*
* * * *
* C:Normality *CHSQ( 2)= .87344[.646]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .85194[.356]*F( 1, 35)= .82488[.370]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

3b) Testing down procedure for 1st difference of the log level of PPP70 variable of interest

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is D2LPPP70
33 observations used for estimation from 1956 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 2.5375 .31455 8.0668[.000]
TIM -.0087306 .0011770 -7.4176[.000]
DTBPPP70 .069377 .023355 2.9706[.007]
DUPPP70 .33963 .064596 5.2576[.000]
DTPPP70 -.018627 .0030456 -6.1160[.000]
LPPP701 -.51012 .063774 -7.9989[.000]
D2PPP70(-1) -.0089893 .0016196 -5.5503[.000]
D2PPP70(-2) -.0084892 .0015783 -5.3788[.000]
D2PPP70(-3) -.0068179 .0013337 -5.1118[.000]
D2PPP70(-4) -.0044868 .0011947 -3.7556[.001]
*******************************************************************************
R-Squared .79851 R-Bar-Squared .71967
S.E. of Regression .014782 F-stat. F( 9, 23) 10.1277[.000]
Mean of Dependent Variable -.1337E-3 S.D. of Dependent Variable .027918
Residual Sum of Squares .0050256 Equation Log-likelihood 98.2055
Akaike Info. Criterion 88.2055 Schwarz Bayesian Criterion 80.7229
DW-statistic 2.2950
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 2.5547[.110]*F( 1, 22)= 1.8460[.188]*
* * * *
* B:Functional Form *CHSQ( 1)= .017663[.894]*F( 1, 22)= .011782[.915]*
* * * *
* C:Normality *CHSQ( 2)= .98404[.611]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .1372E-3[.991]*F( 1, 31)= .1289E-3[.991]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Ordinary least squares estimation with3 lags of the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is D2LPPP70
34 observations used for estimation from 1955 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 2.2258 .37550 5.9277[.000]
TIM -.0068745 .0013521 -5.0843[.000]
```

```
DTBPPP70 .040126 .027095 1.4809[.151]
DUPPP70 .34583 .079712 4.3385[.000]
DTPPP70 -.018276 .0037287 -4.9014[.000]
LPPP701 -.45028 .076198 -5.9093[.000]
D2PPP70(-1) -.0076511 .0019273 -3.9698[.001]
D2PPP70(-2) -.0056259 .0016750 -3.3588[.003]
D2PPP70(-3) -.0046076 .0014475 -3.1831[.004]
*******************************************************************************
R-Squared .66103 R-Bar-Squared .55257
S.E. of Regression .018489 F-stat. F( 8, 25) 6.0942[.000]
Mean of Dependent Variable -.6235E-3 S.D. of Dependent Variable .027640
Residual Sum of Squares .0085457 Equation Log-likelihood 92.6637
Akaike Info. Criterion 83.6637 Schwarz Bayesian Criterion 76.7951
DW-statistic 2.2004
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 1.9059[.167]*F( 1, 24)= 1.4253[.244]*
* * * *
* B:Functional Form *CHSQ( 1)= .066548[.796]*F( 1, 24)= .047068[.830]*
* * * *
* C:Normality *CHSQ( 2)= 8.3752[.015]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .060344[.806]*F( 1, 32)= .056896[.813]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Ordinary least squares estimation with 2lags of the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is D2LPPP70
35 observations used for estimation from 1954 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 1.8363 .40193 4.5688[.000]
TIM -.0055668 .0013672 -4.0718[.000]
DTBPPP70 .023029 .029844 .77166[.447]
DUPPP70 .30474 .089730 3.3962[.002]
DTPPP70 -.015742 .0041571 -3.7867[.001]
LPPP701 -.37184 .081816 -4.5448[.000]
D2PPP70(-1) -.0046405 .0019191 -2.4180[.023]
D2PPP70(-2) -.0043946 .0015563 -2.8238[.009]
*******************************************************************************
R-Squared .53998 R-Bar-Squared .42072
S.E. of Regression .021109 F-stat. F( 7, 27) 4.5276[.002]
Mean of Dependent Variable .2663E-3 S.D. of Dependent Variable .027735
Residual Sum of Squares .012031 Equation Log-likelihood 89.9104
Akaike Info. Criterion 81.9104 Schwarz Bayesian Criterion 75.6890
DW-statistic 2.2073
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 1.4236[.233]*F( 1, 26)= 1.1024[.303]*
* * * *
* B:Functional Form *CHSQ( 1)= .011917[.913]*F( 1, 26)= .0088559[.926]*
* * * *
* C:Normality *CHSQ( 2)= 24.3706[.000]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .033378[.855]*F( 1, 33)= .031500[.860]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Ordinary least squares estimation with 1 lag of the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is D2LPPP70
36 observations used for estimation from 1953 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 1.4662 .41370 3.5442[.001]
TIM -.0044008 .0013420 -3.2793[.003]
DTBPPP70 -.0070503 .030551 -.23077[.819]
DUPPP70 .26337 .097213 2.7093[.011]
DTPPP70 -.013205 .0044575 -2.9624[.006]
LPPP701 -.29696 .084440 -3.5168[.001]
D2PPP70(-1) -.0031107 .0017387 -1.7890[.084]
*******************************************************************************
R-Squared .41210 R-Bar-Squared .29047
S.E. of Regression .023183 F-stat. F( 6, 29) 3.3880[.012]
Mean of Dependent Variable .7988E-3 S.D. of Dependent Variable .027522
Residual Sum of Squares .015586 Equation Log-likelihood 88.3268
Akaike Info. Criterion 81.3268 Schwarz Bayesian Criterion 75.7845
DW-statistic 2.2384
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 1.5514[.213]*F( 1, 28)= 1.2610[.271]*
* * * *
* B:Functional Form *CHSQ( 1)= .65773[.417]*F( 1, 28)= .52109[.476]*
* * * *
* C:Normality *CHSQ( 2)= .73923[.691]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .026743[.870]*F( 1, 34)= .025276[.875]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Ordinary least squares estimation with 0 lags of the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is D2LPPP70
36 observations used for estimation from 1953 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 1.1505 .38766 2.9679[.006]
TIM -.0036312 .0013170 -2.7572[.010]
DTBPPP70 -.019581 .030809 -.63557[.530]
DUPPP70 .21211 .096240 2.2040[.035]
DTPPP70 -.010407 .0043245 -2.4064[.022]
LPPP701 -.23241 .079094 -2.9384[.006]
*******************************************************************************
R-Squared .34722 R-Bar-Squared .23842
S.E. of Regression .024018 F-stat. F( 5, 30) 3.1914[.020]
Mean of Dependent Variable .7988E-3 S.D. of Dependent Variable .027522
Residual Sum of Squares .017306 Equation Log-likelihood 86.4424
Akaike Info. Criterion 80.4424 Schwarz Bayesian Criterion 75.6918
DW-statistic 2.5453
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 3.1446[.076]*F( 1, 29)= 2.7756[.106]*
* * * *
```

```
* B:Functional Form *CHSQ( 1)= .82927[.362]*F( 1, 29)= .68377[.415]*
* * * *
* C:Normality *CHSQ( 2)= 1.1314[.568]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .027978[.867]*F( 1, 34)= .026444[.872]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

3C) Testing down procedure for 1st difference of the log level of PRDR variable of interest

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is D2LPRDR
33 observations used for estimation from 1956 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 1.8293 .60456 3.0258[.006]
TIM -.0081265 .0026277 -3.0926[.005]
DTBPRDR .018763 .025027 .74970[.461]
DUPRDR -.21122 .21309 -.99121[.332]
DTPRDR .0080939 .0063357 1.2775[.214]
LPRDR1 -.35680 .11837 -3.0142[.006]
D2LPRDR(-1) -.71692 .16219 -4.4203[.000]
D2LPRDR(-2) -.68037 .18681 -3.6419[.001]
D2LPRDR(-3) -.42515 .18522 -2.2954[.031]
D2LPRDR(-4) -.30741 .16376 -1.8773[.073]
*******************************************************************************
R-Squared .66840 R-Bar-Squared .53864
S.E. of Regression .016979 F-stat. F( 9, 23) 5.1511[.001]
Mean of Dependent Variable .0012438 S.D. of Dependent Variable .024997
Residual Sum of Squares .0066307 Equation Log-likelihood 93.6321
Akaike Info. Criterion 83.6321 Schwarz Bayesian Criterion 76.1495
DW-statistic 2.1656
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 2.1009[.147]*F( 1, 22)= 1.4958[.234]*
* * * *
* B:Functional Form *CHSQ( 1)= 1.5791[.209]*F( 1, 22)= 1.1057[.304]*
* * * *
* C:Normality *CHSQ( 2)= .034295[.983]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .84837[.357]*F( 1, 31)= .81798[.373]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Ordinary least squares estimation with 3 lags of the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is D2LPRDR
34 observations used for estimation from 1955 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 1.6468 .59642 2.7612[.011]
TIM -.0073702 .0026548 -2.7762[.010]
DTBPRDR .036910 .025249 1.4619[.156]
DUPRDR -.27377 .20904 -1.3097[.202]
DTPRDR .0094859 .0062581 1.5158[.142]
LPRDR1 -.32087 .11647 -2.7550[.011]
D2LPRDR(-1) -.60929 .16302 -3.7374[.001]
D2LPRDR(-2) -.44321 .16226 -2.7314[.011]
D2LPRDR(-3) -.23711 .16676 -1.4219[.167]
*******************************************************************************
```

```
R-Squared .59206 R-Bar-Squared .46152
S.E. of Regression .018095 F-stat. F( 8, 25) 4.5355[.002]
Mean of Dependent Variable .9922E-3 S.D. of Dependent Variable .024659
Residual Sum of Squares .0081860 Equation Log-likelihood 93.3948
Akaike Info. Criterion 84.3948 Schwarz Bayesian Criterion 77.5262
DW-statistic 2.2722
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 5.2333[.022]*F( 1, 24)= 4.3661[.047]*
* * * *
* B:Functional Form *CHSQ( 1)= 2.7163[.099]*F( 1, 24)= 2.0838[.162]*
* * * *
* C:Normality *CHSQ( 2)= .072714[.964]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .29121[.589]*F( 1, 32)= .27645[.603]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Ordinary least squares estimation with 2 lags of the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is D2LPRDR
35 observations used for estimation from 1954 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 1.4611 .58037 2.5175[.018]
TIM -.0066299 .0026335 -2.5175[.018]
DTBPRDR .043500 .025793 1.6865[.103]
DUPRDR -.30318 .20137 -1.5056[.144]
DTPRDR .010060 .0060619 1.6596[.109]
LPRDR1 -.28417 .11308 -2.5129[.018]
D2LPRDR(-1) -.45320 .14345 -3.1592[.004]
D2LPRDR(-2) -.33129 .14624 -2.2653[.032]
*******************************************************************************
R-Squared .53044 R-Bar-Squared .40870
S.E. of Regression .018709 F-stat. F( 7, 27) 4.3572[.002]
Mean of Dependent Variable .7699E-3 S.D. of Dependent Variable .024330
Residual Sum of Squares .0094503 Equation Log-likelihood 94.1357
Akaike Info. Criterion 86.1357 Schwarz Bayesian Criterion 79.9143
DW-statistic 2.3376
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 4.1229[.042]*F( 1, 26)= 3.4717[.074]*
* * * *
* B:Functional Form *CHSQ( 1)= 1.8869[.170]*F( 1, 26)= 1.4816[.234]*
* * * *
* C:Normality *CHSQ( 2)= .46738[.792]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .20522[.651]*F( 1, 33)= .19464[.662]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Ordinary least squares with 1 lag of the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is D2LPRDR
35 observations used for estimation from 1954 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 1.6094 .61774 2.6053[.015]
TIM -.0072192 .0028073 -2.5715[.016]
DTBPRDR .059961 .026512 2.2617[.032]
DUPRDR -.40167 .21063 -1.9070[.067]
DTPRDR .012798 .0063634 2.0111[.054]
LPRDR1 -.31346 .12035 -2.6046[.015]
D2LPRDR(-1) -.34687 .14522 -2.3887[.024]
*******************************************************************************
R-Squared .44119 R-Bar-Squared .32144
S.E. of Regression .020041 F-stat. F( 6, 28) 3.6844[.008]
Mean of Dependent Variable .7699E-3 S.D. of Dependent Variable .024330
Residual Sum of Squares .011246 Equation Log-likelihood 91.0906
Akaike Info. Criterion 84.0906 Schwarz Bayesian Criterion 78.6468
DW-statistic 2.3219 Durbin's h-statistic -1.8607[.063]
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 5.1020[.024]*F( 1, 27)= 4.6075[.041]*
* * * *
* B:Functional Form *CHSQ( 1)= 1.5964[.206]*F( 1, 27)= 1.2904[.266]*
* * * *
* C:Normality *CHSQ( 2)= .18307[.913]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .11421[.735]*F( 1, 33)= .10803[.744]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Ordinary least squares estimation with 0 lags of the dependent variable

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is D2LPRDR
37 observations used for estimation from 1952 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT 1.1871 .63076 1.8821[.069]
TIM -.0055846 .0029577 -1.8882[.068]
DTBPRDR .060085 .029814 2.0153[.053]
DUPRDR -.33972 .22500 -1.5099[.141]
DTPRDR .010649 .0067883 1.5687[.127]
LPRDR1 -.22986 .12243 -1.8774[.070]
*******************************************************************************
R-Squared .25720 R-Bar-Squared .13740
S.E. of Regression .022597 F-stat. F( 5, 31) 2.1468[.086]
Mean of Dependent Variable .0016094 S.D. of Dependent Variable .024330
Residual Sum of Squares .015829 Equation Log-likelihood 91.0009
Akaike Info. Criterion 85.0009 Schwarz Bayesian Criterion 80.1681
DW-statistic 2.5998
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 4.5654[.033]*F( 1, 30)= 4.2227[.049]*
* * * *
* B:Functional Form *CHSQ( 1)= .22263[.637]*F( 1, 30)= .18161[.673]*
* * * *
* C:Normality *CHSQ( 2)= .85479[.652]* Not applicable *
* * * *
```

```
* D:Heteroscedasticity*CHSQ( 1)= .42814[.513]*F( 1, 35)= .40974[.526]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

APPENDIX 3 Section A

For the 1st equation

```
Variable Deletion Test (OLS case)
*******************************************************************************
Dependent variable is D2LPRDR
List of the variables deleted from the regression:
DTBPRDR DUPRDR DTPRDR
37 observations used for estimation from 1952 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT .37774 .27479 1.3746[.178]
TIM -.0014049 .0010620 -1.3229[.195]
LPRDR1 -.073900 .054106 -1.3658[.181]
*******************************************************************************
Joint test of zero restrictions on the coefficients of deleted variables:
Lagrange Multiplier Statistic CHSQ( 3)= 7.9953[.046]
Likelihood Ratio Statistic CHSQ( 3)= 9.0081[.029]
F Statistic F( 3, 31)= 2.8485[.053]
*******************************************************************************
```

For the 2nd equation

```
Variable Deletion Test (OLS case)
*******************************************************************************
Dependent variable is D2LPPP70
List of the variables deleted from the regression:
DTBPPP70 DUPPP70 DTPPP70
37 observations used for estimation from 1952 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT .25577 .14944 1.7115[.096]
TIM -.0018114 .0011875 -1.5253[.136]
LPPP701 -.049547 .028561 -1.7348[.092]
*******************************************************************************
Joint test of zero restrictions on the coefficients of deleted variables:
Lagrange Multiplier Statistic CHSQ( 3)= 11.2673[.010]
Likelihood Ratio Statistic CHSQ( 3)= 13.4367[.004]
F Statistic F( 3, 31)= 4.5245[.010]
```

Variable deletion test

```
For the third equation
Variable Deletion Test (OLS case)
*******************************************************************************
Dependent variable is DLPRDR
List of the variables deleted from the regression:
DTBPRDR DUPRDR DTPRDR
38 observations used for estimation from 1951 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
CONSTANT -.20933 .21951 -.95360[.347]
TIM .0021774 .8716E-3 2.4980[.017]
LPRDR1 .031571 .043079 .73285[.469]
*******************************************************************************
Joint test of zero restrictions on the coefficients of deleted variables:
Lagrange Multiplier Statistic CHSQ( 3)= 17.8141[.000]
Likelihood Ratio Statistic CHSQ( 3)= 24.0389[.000]
F Statistic F( 3, 32)= 9.4134[.000]
*******************************************************************************
```

Appendix 4 Section A

VAR ESTIMATION RESULTS

endogenous variables: STDMER70_log_d1 PPP70_log_d1
exogenous variables: PRDRATIO_log_d1
deterministic variables: dtber70imp dtbppp70imp dtbprdrimp CONST TREND
endogenous lags: 1

```
exogenous lags: 0
sample range: [1952, 1988], T = 37
modulus of the eigenvalues of the reverse characteristic polynomial :
|z| = ( 3.4286 1.5358 )
Legend:
======= Equation 1 Equation 2 ...
------------------------------------------
Variable 1 | Coefficient ...
| (Std. Dev.)
| {p - Value}
| [t - Value]
Variable 2 | ...
------------------------------------------
Lagged endogenous term:
=======================
STDMER70_log_d1 PPP70_log_d1
---------------------------------------------------
STDMER70_log_d1(t-1)| 0.278 -0.011
| (0.220) (0.088)
| {0.206} {0.904}
| [1.265] [-0.121]
PPP70_log_d1 (t-1)| 0.492 0.665
| (0.322) (0.129)
| {0.127} {0.000}
| [1.525] [5.162]
---------------------------------------------------
Current and lagged exogenous term:
==================================
STDMER70_log_d1 PPP70_log_d1
-------------------------------------------------
PRDRATIO_log_d1(t)| -0.777 0.582
| (0.552) (0.220)
| {0.159} {0.008}
| [-1.407] [2.638]
-------------------------------------------------
Deterministic term:
=================STDMER70_log_d1 PPP70_log_d1
---------------------------------------------
dtber70imp (t)| -0.112 -0.021
| (0.059) (0.024)
| {0.058} {0.364}
| [-1.895] [-0.907]
dtbppp70imp(t)| -0.017 -0.045
| (0.068) (0.027)
| {0.805} {0.100}
```

VAR Estimation results

```
| [-0.247] [-1.646]
dtbprdrimp (t)| 0.156 0.019
| (0.076) (0.030)
| {0.041} {0.543}
| [2.048] [0.609]
CONST (t)| -0.028 0.022
| (0.032) (0.013)
| {0.389} {0.086}
| [-0.862] [1.716]
TREND (t)| 0.000 -0.001
| (0.001) (0.001)
| {0.775} {0.030}
| [0.285] [-2.175]
---------------------------------------------
```

Appendix 4 Section B

VAR (1)

```
OPTIMAL ENDOGENOUS LAGS FROM INFORMATION CRITERIA
endogenous variables: STDMER70_log_d1 PPP70_log_d1
exogenous variables: PRDRATIO
exogenous lags (fixed): 0
deterministic variables: dtbprdrimp dter70imp dtppp70imp CONST TREND
sample range: [1955, 1988], T = 34
optimal number of lags (searched up to 4 lags of levels):
Akaike Info Criterion: 1
Final Prediction Error: 1
```

Hannan-Quinn Criterion: 1
Schwarz Criterion: 1

Diagnostics

```
PORTMANTEAU TEST is not implemented if exogenous variables are in the model.
LM-TYPE TEST FOR AUTOCORRELATION with 2 lags
Reference: Doornik (1996), LM test and LMF test (with F-approximation)
LM statistic: 11.5930
p-value: 0.1703
df: 8.0000
LMF statistic: 1.1912
p-value: 0.3242
df1: 8.0000
df2: 48.0000
TESTS FOR NONNORMALITY
Reference: Doornik & Hansen (1994)
joint test statistic: 54.7001
p-value: 0.0000
degrees of freedom: 4.0000
skewness only: 16.6314
p-value: 0.0002
kurtosis only: 38.0687
p-value: 0.0000
Reference: Lütkepohl (1993), Introduction to Multiple Time Series Analysis, 2ed, p. 153
joint test statistic: 57.2354
p-value: 0.0000
degrees of freedom: 4.0000
skewness only: 16.5346
p-value: 0.0003
kurtosis only: 40.7008
p-value: 0.0000



JARQUE-BERA TEST
variable teststat p-Value(Chi^2) skewness kurtosis
u1 11.9897 0.0025 -0.3921 5.6762
u2 36.6773 0.0000 -1.5575 6.7534
*** Mon, 21 Apr 2008 13:47:05 ***
MULTIVARIATE ARCH-LM TEST with 2 lags
VARCHLM test statistic: 33.7168
p-value(chi^2): 0.0136
degrees of freedom: 18.0000
```

Appendix 4 Section C

VAR(2)

```
OPTIMAL ENDOGENOUS LAGS FROM INFORMATION CRITERIA
endogenous variables: STDMER70_log_d1 PPP70_log_d1
exogenous variables: PRDRATIO
exogenous lags (fixed): 0
deterministic variables: dtbprdrimp dter70imp dtppp70imp CONST TREND
sample range: [1955, 1988], T = 34
optimal number of lags (searched up to 4 lags of levels):
Akaike Info Criterion: 1
Final Prediction Error: 1
Hannan-Quinn Criterion: 1
Schwarz Criterion: 1
```

Diagnostics

```
PORTMANTEAU TEST is not implemented if exogenous variables are in the model.
*** Mon, 21 Apr 2008 14:00:39 ***
LM-TYPE TEST FOR AUTOCORRELATION with 4 lags
Reference: Doornik (1996), LM test and LMF test (with F-approximation)
LM statistic: 27.5721
p-value: 0.0355
df: 16.0000
LMF statistic: 1.3778
p-value: 0.2106
df1: 16.0000
df2: 34.0000
TESTS FOR NONNORMALITY
Reference: Doornik & Hansen (1994)
joint test statistic: 30.2086
p-value: 0.0000
degrees of freedom: 4.0000
skewness only: 2.4928
p-value: 0.2875
```

```
kurtosis only: 27.7158
p-value: 0.0000
Reference: Lütkepohl (1993), Introduction to Multiple Time Series Analysis, 2ed, p. 153
joint test statistic: 31.2826
p-value: 0.0000
degrees of freedom: 4.0000
skewness only: 2.3968
p-value: 0.3017
kurtosis only: 28.8858
p-value: 0.0000


JARQUE-BERA TEST
variable teststat p-Value(Chi^2) skewness kurtosis
u1 14.7172 0.0006 -0.4842 5.9789
u2 13.6716 0.0011 -0.3837 5.9198
*** Mon, 21 Apr 2008 14:00:39 ***
MULTIVARIATE ARCH-LM TEST with 4 lags
VARCHLM test statistic: 61.6851
p-value(chi^2): 0.0049
degrees of freedom: 36.0000
*** Mon, 21 Apr 2008 14:02:58 ***
PORTMANTEAU TEST is not implemented if exogenous variables are in the model.
PORTMANTEAU TEST is not implemented if exogenous variables are in the model.
*** Mon, 21 Apr 2008 14:03:50 ***
LM-TYPE TEST FOR AUTOCORRELATION with 2 lags
Reference: Doornik (1996), LM test and LMF test (with F-approximation)
LM statistic: 20.1986
p-value: 0.0096
df: 8.0000
LMF statistic: 2.1629
p-value: 0.0505
df1: 8.0000
df2: 42.0000
*** Mon, 21 Apr 2008 14:03:50 ***
TESTS FOR NONNORMALITY
Reference: Doornik & Hansen (1994)
joint test statistic: 30.2086
p-value: 0.0000
degrees of freedom: 4.0000
skewness only: 2.4928
p-value: 0.2875
kurtosis only: 27.7158
p-value: 0.0000
Reference: Lütkepohl (1993), Introduction to Multiple Time Series Analysis, 2ed, p. 153
joint test statistic: 31.2826
p-value: 0.0000
degrees of freedom: 4.0000
skewness only: 2.3968
p-value: 0.3017
kurtosis only: 28.8858
p-value: 0.0000
*** Mon, 21 Apr 2008 14:03:50 ***
JARQUE-BERA TEST


variable teststat p-Value(Chi^2) skewness kurtosis
u1 14.7172 0.0006 -0.4842 5.9789
u2 13.6716 0.0011 -0.3837 5.9198
*** Mon, 21 Apr 2008 14:03:50 ***
MULTIVARIATE ARCH-LM TEST with 2 lags
VARCHLM test statistic: 33.1721
p-value(chi^2): 0.0159
degrees of freedom: 18.0000
```

Appendix 4 Section C

VAR(4) D2LER70 D2PPP70 & Constant TIM DTBPPP70 DTBPRDR DTBER70 DLPRDR

```
OLS estimation of a single equation in the Unrestricted VAR
*******************************************************************************
Dependent variable is D2LER70
33 observations used for estimation from 1956 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
D2LER70(-1) -.48133 .23504 -2.0479[.055]
```

```
D2LER70(-2) -.62863 .27002 -2.3280[.031]
D2LER70(-3) -.32485 .30243 -1.0741[.296]
D2LER70(-4) -.30869 .28460 -1.0847[.292]
D2LPPP70(-1) .40302 .52436 .76859[.452]
D2LPPP70(-2) .73243 .49660 1.4749[.157]
D2LPPP70(-3) -.28094 .49289 -.56998[.575]
D2LPPP70(-4) -.067730 .45999 -.14724[.884]
CONSTANT -.060975 .047927 -1.2723[.219]
TIM .0017685 .0017321 1.0210[.320]
DTBPPP70 -.0032485 .080991 -.040109[.968]
DTBPRDR .20823 .11399 1.8268[.083]
DTBER70 -.11135 .069804 -1.5952[.127]
DLPRDR -1.1371 .70732 -1.6076[.124]
*******************************************************************************
R-Squared .50636 R-Bar-Squared .16861
S.E. of Regression .067271 F-stat. F( 13, 19) 1.4992[.205]
Mean of Dependent Variable .0017471 S.D. of Dependent Variable .073778
Residual Sum of Squares .085984 Equation Log-likelihood 51.3518
Akaike Info. Criterion 37.3518 Schwarz Bayesian Criterion 26.8762
DW-statistic 1.8386 System Log-likelihood 136.5295
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= .10192[.750]*F( 1, 18)= .055766[.816]*
* * * *
* B:Functional Form *CHSQ( 1)= 1.5237[.217]*F( 1, 18)= .87132[.363]*
* * * *
* C:Normality *CHSQ( 2)= .051795[.974]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .10192[.750]*F( 1, 31)= .096044[.759]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Determining the appropriate order of VAR

Appendix 4 Section D

VAR (4) D2LER70 D2PPP70 & Constant TIM DTBPPP70 DTBPRDR DTBER70 DLPRDR

```
OLS estimation of a single equation in the Unrestricted VAR
*******************************************************************************
Dependent variable is D2LPPP70
33 observations used for estimation from 1956 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
D2LER70(-1) .013410 .085195 .15740[.877]
D2LER70(-2) .050172 .097878 .51259[.614]
D2LER70(-3) .021466 .10962 .19581[.847]
D2LER70(-4) .028777 .10316 .27895[.783]
D2LPPP70(-1) -.16857 .19007 -.88687[.386]
D2LPPP70(-2) -.10153 .18001 -.56403[.579]
D2LPPP70(-3) -.38099 .17866 -2.1325[.046]
D2LPPP70(-4) -.17588 .16674 -1.0548[.305]
CONSTANT .024893 .017373 1.4329[.168]
TIM -.8171E-3 .6279E-3 -1.3014[.209]
DTBPPP70 -.051170 .029357 -1.7430[.097]
DTBPRDR .055808 .041318 1.3507[.193]
DTBER70 -.026864 .025302 -1.0617[.302]
DLPRDR .38939 .25639 1.5188[.145]
*******************************************************************************
R-Squared .54705 R-Bar-Squared .23714
S.E. of Regression .024385 F-stat. F( 13, 19) 1.7652[.126]
Mean of Dependent Variable -.1337E-3 S.D. of Dependent Variable .027918
Residual Sum of Squares .011297 Equation Log-likelihood 84.8398
Akaike Info. Criterion 70.8398 Schwarz Bayesian Criterion 60.3642
DW-statistic 2.7945 System Log-likelihood 136.5295
*******************************************************************************
Diagnostic Tests
*******************************************************************************
```

```
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 13.0013[.000]*F( 1, 18)= 11.7020[.003]*
* * * *
* B:Functional Form *CHSQ( 1)= 1.5726[.210]*F( 1, 18)= .90071[.355]*
* * * *
* C:Normality *CHSQ( 2)= 15.4696[.000]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .29185[.589]*F( 1, 31)= .27661[.603]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Appendix 4 Section E

deletion test for the exogenous and deterministic variables

```
LR Test of Deletion of Deterministic/Exogenous Variables in the VAR
*******************************************************************************
Based on 33 observations from 1956 to 1988. Order of VAR = 4
List of variables included in the unrestricted VAR:
D2LER70 D2LPPP70
List of deterministic and/or exogenous variables:
CONSTANT TIM DTBPPP70 DTBPRDR DTBER70
DLPRDR
Maximized value of log-likelihood = 136.5295
*******************************************************************************
List of variables included in the restricted VAR:
D2LER70 D2LPPP70
Maximized value of log-likelihood = 123.5240
*******************************************************************************
LR test of restrictions, CHSQ( 12)= 26.0111[.011]
*******************************************************************************
```

Appendix 4 Section F

VAR (3) D2LER70 D2PPP70 & Constant TIM DTBPPP70 DTBPRDR DTBER70 DLPRDR

```
OLS estimation of a single equation in the Unrestricted VAR
*******************************************************************************
Dependent variable is D2LER70
34 observations used for estimation from 1955 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
D2LER70(-1) -.41830 .21421 -1.9527[.064]
D2LER70(-2) -.47159 .20501 -2.3004[.031]
D2LER70(-3) -.13636 .23507 -.58010[.568]
D2LPPP70(-1) .20484 .44597 .45932[.651]
D2LPPP70(-2) .53190 .42024 1.2657[.219]
D2LPPP70(-3) -.13511 .43271 -.31225[.758]
CONSTANT -.073498 .042898 -1.7133[.101]
TIM .0022877 .0015433 1.4823[.152]
DTBPPP70 .017972 .073834 .24341[.810]
DTBPRDR .14578 .089568 1.6276[.118]
DTBER70 -.10703 .066198 -1.6169[.120]
DLPRDR -1.3191 .63843 -2.0661[.051]
*******************************************************************************
R-Squared .47486 R-Bar-Squared .21229
S.E. of Regression .064481 F-stat. F( 11, 22) 1.8085[.114]
Mean of Dependent Variable .0016957 S.D. of Dependent Variable .072652
Residual Sum of Squares .091472 Equation Log-likelihood 52.3635
Akaike Info. Criterion 40.3635 Schwarz Bayesian Criterion 31.2053
DW-statistic 1.7474 System Log-likelihood 137.8955
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= .94260[.332]*F( 1, 21)= .59880[.448]*
* * * *
* B:Functional Form *CHSQ( 1)= .57968[.446]*F( 1, 21)= .36425[.553]*
```

```
* * * *
* C:Normality *CHSQ( 2)= .0022221[.999]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .20796[.648]*F( 1, 32)= .19693[.660]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Appendix 4 Section G

VAR(3) D2LER70 D2PPP70 & Constant TIM DTBPPP70 DTBPRDR DTBER70 DLPRDR

```
OLS estimation of a single equation in the Unrestricted VAR
*******************************************************************************
Dependent variable is D2LPPP70
34 observations used for estimation from 1955 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
D2LER70(-1) -.012008 .081404 -.14751[.884]
D2LER70(-2) .018665 .077906 .23958[.813]
D2LER70(-3) .0083910 .089330 .093933[.926]
D2LPPP70(-1) -.14320 .16948 -.84498[.407]
D2LPPP70(-2) -.063071 .15970 -.39494[.697]
D2LPPP70(-3) -.30032 .16444 -1.8263[.081]
CONSTANT .016588 .016302 1.0175[.320]
TIM -.5559E-3 .5865E-3 -.94787[.353]
DTBPPP70 -.058254 .028058 -2.0762[.050]
DTBPRDR .063226 .034037 1.8576[.077]
DTBER70 -.022005 .025156 -.87473[.391]
DLPRDR .31225 .24262 1.2870[.211]
*******************************************************************************
R-Squared .47604 R-Bar-Squared .21406
S.E. of Regression .024504 F-stat. F( 11, 22) 1.8171[.112]
Mean of Dependent Variable -.6235E-3 S.D. of Dependent Variable .027640
Residual Sum of Squares .013210 Equation Log-likelihood 85.2598
Akaike Info. Criterion 73.2598 Schwarz Bayesian Criterion 64.1017
DW-statistic 2.6455 System Log-likelihood 137.8955
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 10.9638[.001]*F( 1, 21)= 9.9946[.005]*
* * * *
* B:Functional Form *CHSQ( 1)= .3452E-4[.995]*F( 1, 21)= .2132E-4[.996]*
* * * *
* C:Normality *CHSQ( 2)= 7.0169[.030]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .54641[.460]*F( 1, 32)= .52267[.475]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Appendix 4 Section H

Var (3) deletion test for the exogenous and deterministic variables

```
LR Test of Deletion of Deterministic/Exogenous Variables in the VAR
*******************************************************************************
Based on 34 observations from 1955 to 1988. Order of VAR = 3
List of variables included in the unrestricted VAR:
D2LER70 D2LPPP70
List of deterministic and/or exogenous variables:
CONSTANT TIM DTBPPP70 DTBPRDR DTBER70
DLPRDR
Maximized value of log-likelihood = 137.8955
*******************************************************************************
List of variables included in the restricted VAR:
D2LER70 D2LPPP70
Maximized value of log-likelihood = 123.7389
```

```
*****************************************************************************
LR test of restrictions, CHSQ( 12)= 28.3133[.005]
```

Appendix 4 Section I

Var(2) D2LER70 D2PPP70 & Constant TIM DTBPPP70 DTBPRDR DTBER70 DLPRDR

```
OLS estimation of a single equation in the Unrestricted VAR
*****************************************************************************
Dependent variable is D2LER70
35 observations used for estimation from 1954 to 1988
*****************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
D2LER70(-1) -.37939 .19152 -1.9809[.059]
D2LER70(-2) -.43468 .18129 -2.3977[.024]
D2LPPP70(-1) .17379 .41072 .42313[.676]
D2LPPP70(-2) .40703 .38217 1.0651[.297]
CONSTANT -.062669 .039063 -1.6043[.121]
TIM .0019631 .0014095 1.3927[.176]
DTBPPP70 .022132 .070752 .31282[.757]
DTBPRDR .11670 .075687 1.5419[.136]
DTBER70 -.11209 .063356 -1.7691[.089]
DLPRDR -1.2617 .60649 -2.0803[.048]
*****************************************************************************
R-Squared .45035 R-Bar-Squared .25247
S.E. of Regression .061890 F-stat. F( 9, 25) 2.2759[.051]
Mean of Dependent Variable .0018597 S.D. of Dependent Variable .071583
Residual Sum of Squares .095759 Equation Log-likelihood 53.6093
Akaike Info. Criterion 43.6093 Schwarz Bayesian Criterion 35.8326
DW-statistic 1.7592 System Log-likelihood 138.7862
*****************************************************************************
Diagnostic Tests
*****************************************************************************
* Test Statistics * LM Version * F Version *
*****************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= .39355[.530]*F( 1, 24)= .27293[.606]*
* * * *
* B:Functional Form *CHSQ( 1)= .0054056[.941]*F( 1, 24)= .0037073[.952]*
* * * *
* C:Normality *CHSQ( 2)= .011309[.994]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .48827[.485]*F( 1, 33)= .46688[.499]*
*****************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Appendix 4 Section J

VAR(2) D2LER70 D2PPP70 & Constant TIM DTBPPP70 DTBPRDR DTBER70 DLPRDR

```
OLS estimation of a single equation in the Unrestricted VAR
*****************************************************************************
Dependent variable is D2LPPP70
35 observations used for estimation from 1954 to 1988
*****************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
D2LER70(-1) -.036021 .077939 -.46218[.648]
D2LER70(-2) .013348 .073776 .18092[.858]
D2LPPP70(-1) -.081589 .16714 -.48814[.630]
D2LPPP70(-2) -.093993 .15552 -.60438[.551]
CONSTANT .020451 .015896 1.2865[.210]
TIM -.6690E-3 .5736E-3 -1.1663[.255]
DTBPPP70 -.057401 .028792 -1.9936[.057]
DTBPRDR .049216 .030801 1.5979[.123]
DTBER70 -.024051 .025783 -.93284[.360]
DLPRDR .32531 .24681 1.3180[.199]
*****************************************************************************
R-Squared .39364 R-Bar-Squared .17536
S.E. of Regression .025186 F-stat. F( 9, 25) 1.8033[.118]
Mean of Dependent Variable .2663E-3 S.D. of Dependent Variable .027735
Residual Sum of Squares .015858 Equation Log-likelihood 85.0769
Akaike Info. Criterion 75.0769 Schwarz Bayesian Criterion 67.3001
```

```
DW-statistic 2.6390 System Log-likelihood 138.7862
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 11.9737[.001]*F( 1, 24)= 12.4800[.002]*
* * * *
* B:Functional Form *CHSQ( 1)= .34411[.557]*F( 1, 24)= .23830[.630]*
* * * *
* C:Normality *CHSQ( 2)= 15.7281[.000]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .32923[.566]*F( 1, 33)= .31336[.579]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Appendix 4 Section J

VAR(2) D2LER70 D2PPP70 & Constant TIM DTBPPP70 DTBPRDR DTBER70 DLPRDR

```
OLS estimation of a single equation in the Unrestricted VAR
*******************************************************************************
Dependent variable is D2LPPP70
35 observations used for estimation from 1954 to 1988
*******************************************************************************
Regressor Coefficient Standard Error T-Ratio[Prob]
D2LER70(-1) -.036021 .077939 -.46218[.648]
D2LER70(-2) .013348 .073776 .18092[.858]
D2LPPP70(-1) -.081589 .16714 -.48814[.630]
D2LPPP70(-2) -.093993 .15552 -.60438[.551]
CONSTANT .020451 .015896 1.2865[.210]
TIM -.6690E-3 .5736E-3 -1.1663[.255]
DTBPPP70 -.057401 .028792 -1.9936[.057]
DTBPRDR .049216 .030801 1.5979[.123]
DTBER70 -.024051 .025783 -.93284[.360]
DLPRDR .32531 .24681 1.3180[.199]
*******************************************************************************
R-Squared .39364 R-Bar-Squared .17536
S.E. of Regression .025186 F-stat. F( 9, 25) 1.8033[.118]
Mean of Dependent Variable .2663E-3 S.D. of Dependent Variable .027735
Residual Sum of Squares .015858 Equation Log-likelihood 85.0769
Akaike Info. Criterion 75.0769 Schwarz Bayesian Criterion 67.3001
DW-statistic 2.6390 System Log-likelihood 138.7862
*******************************************************************************
Diagnostic Tests
*******************************************************************************
* Test Statistics * LM Version * F Version *
*******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 11.9737[.001]*F( 1, 24)= 12.4800[.002]*
* * * *
* B:Functional Form *CHSQ( 1)= .34411[.557]*F( 1, 24)= .23830[.630]*
* * * *
* C:Normality *CHSQ( 2)= 15.7281[.000]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .32923[.566]*F( 1, 33)= .31336[.579]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Appendix 4 Section K

```
Deletion test for Deterministic/Exogenous Variables
LR Test of Deletion of Deterministic/Exogenous Variables in the VAR
*******************************************************************************
Based on 35 observations from 1954 to 1988. Order of VAR = 2
List of variables included in the unrestricted VAR:
D2LER70 D2LPPP70
```

List of deterministic and/or exogenous variables:
CONSTANT TIM DTBPPP70 DTBPRDR DTBER70
DLPRDR
Maximized value of log-likelihood = 138.7862
****
List of variables included in the restricted VAR:
D2LER70 D2LPPP70
Maximized value of log-likelihood = 126.1561
****
LR test of restrictions, CHSQ(12)= 25.2601[.014]

Appendix 4 Section L

VAR (1) D2LER70 D2PPP70 & Constant TIM DTBPPP70 DTBPRDR DTBER70 DLPRDR

OLS estimation of a single equation in the Unrestricted VAR
****
Dependent variable is D2LER70
36 observations used for estimation from 1953 to 1988
****
Regressor Coefficient Standard Error T-Ratio[Prob]
D2LER70(-1) -.20419 .19625 -1.0405[.307]
D2LPPP70(-1) .061751 .41722 .14801[.883]
CONSTANT -.065406 .038507 -1.6985[.100]
TIM .0022402 .0014047 1.5948[.122]
DTBPPP70 .067249 .075014 .89649[.378]
DTBPRDR .055608 .078490 .70847[.485]
DTBER70 -.10707 .068773 -1.5568[.131]
DLPRDR -1.2591 .63296 -1.9892[.057]
****
R-Squared .27110 R-Bar-Squared .088872
S.E. of Regression .067397 F-stat. F(7, 28) 1.4877[.212]
Mean of Dependent Variable .0013949 S.D. of Dependent Variable .070608
Residual Sum of Squares .12719 Equation Log-likelihood 50.5394
Akaike Info. Criterion 42.5394 Schwarz Bayesian Criterion 36.2053
DW-statistic 1.7283 System Log-likelihood 138.4420
****
Diagnostic Tests
****
*** Test Statistics * LM Version * F Version ***
****
*** * * ***
*** A:Serial Correlation*CHSQ(1)= .44101[.507]*F(1, 27)= .33486[.568]***
*** * * ***
*** B:Functional Form *CHSQ(1)= .015285[.902]*F(1, 27)= .011469[.916]***
*** * * ***
*** C:Normality *CHSQ(2)= 1.5198[.468]* Not applicable ***
*** * * ***
*** D:Heteroscedasticity*CHSQ(1)= .59962[.439]*F(1, 34)= .57590[.453]***
****
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values

Appendix 4 Section M

VAR (1) D2LER70 D2PPP70 & Constant TIM DTBPPP70 DTBPRDR DTBER70 DLPRDR

OLS estimation of a single equation in the Unrestricted VAR
****
Dependent variable is D2LPPP70
36 observations used for estimation from 1953 to 1988
****
Regressor Coefficient Standard Error T-Ratio[Prob]
D2LER70(-1) -.044240 .069944 -.63251[.532]
D2LPPP70(-1) -.081311 .14870 -.54682[.589]
CONSTANT .021961 .013724 1.6002[.121]
TIM -.7288E-3 .5006E-3 -1.4558[.157]
DTBPPP70 -.061114 .026735 -2.2859[.030]
DTBPRDR .053534 .027974 1.9137[.066]
DTBER70 -.024626 .024511 -1.0047[.324]
DLPRDR .33486 .22559 1.4844[.149]

```
******************************************************************************
R-Squared .39059 R-Bar-Squared .23824
S.E. of Regression .024021 F-stat. F( 7, 28) 2.5638[.036]
Mean of Dependent Variable .7988E-3 S.D. of Dependent Variable .027522
Residual Sum of Squares .016156 Equation Log-likelihood 87.6801
Akaike Info. Criterion 79.6801 Schwarz Bayesian Criterion 73.3460
DW-statistic 2.5847 System Log-likelihood 138.4420
******************************************************************************
Diagnostic Tests
******************************************************************************
* Test Statistics * LM Version * F Version *
******************************************************************************
* * * *
* A:Serial Correlation*CHSQ( 1)= 7.7822[.005]*F( 1, 27)= 7.4464[.011]*
* * * *
* B:Functional Form *CHSQ( 1)= .52222[.470]*F( 1, 27)= .39743[.534]*
* * * *
* C:Normality *CHSQ( 2)= 12.6376[.002]* Not applicable *
* * * *
* D:Heteroscedasticity*CHSQ( 1)= .48971[.484]*F( 1, 34)= .46888[.498]*
******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Appendix 4 Section N

```
LR Test of Deletion of Deterministic/Exogenous Variables in the VAR
******************************************************************************
Based on 36 observations from 1953 to 1988. Order of VAR = 1
List of variables included in the unrestricted VAR:
D2LER70 D2LPPP70
List of deterministic and/or exogenous variables:
CONSTANT TIM DTBPPP70 DTBPRDR DTBER70
DLPRDR
Maximized value of log-likelihood = 138.4420
******************************************************************************
List of variables included in the restricted VAR:
D2LER70 D2LPPP70
Maximized value of log-likelihood = 125.1248
******************************************************************************
LR test of restrictions, CHSQ( 12)= 26.6343[.009]
```

Appendix 4 Section O

```
Test Statistics and Choice Criteria for Selecting the Order of the VAR Model
******************************************************************************
Based on 33 observations from 1956 to 1988. Order of VAR = 4
List of variables included in the unrestricted VAR:
D2LER70 D2LPPP70
List of deterministic and/or exogenous variables:
CONSTANT TIM DTBPPP70 DTBPRDR DTBER70
DLPRDR
******************************************************************************
Order LL AIC SBC LR test Adjusted LR test
4 136.5295 108.5295 87.5784 ------ ------
3 134.5113 110.5113 92.5532 CHSQ( 4)= 4.0364[.401] 2.3240[.676]
2 130.2484 110.2484 95.2833 CHSQ( 8)= 12.5622[.128] 7.2328[.512]
1 125.3303 109.3303 97.3583 CHSQ( 12)= 22.3984[.033] 12.8960[.377]
0 124.2242 112.2242 103.2452 CHSQ( 16)= 24.6106[.077] 14.1697[.586]
******************************************************************************
AIC=Akaike Information Criterion SBC=Schwarz Bayesian Criterion
```

Appendix 5 Section A

```
Wald test of restriction(s) imposed on parameters
******************************************************************************
Based on VAR regression of DLER70 on:
DLER70(-1) DLER70(-2) DLPPP70(-1) DLPPP70(-2) CONSTANT
TIM DTBPPP70 DTBPRDR DTBER70 DLPRDR
36 observations used for estimation from 1953 to 1988
******************************************************************************
Coefficients A1 to A10 are assigned to the above regressors respectively.
List of restriction(s) for the Wald test:
```

```
A2=0; A4 =0;
******************************************************************************
Wald Statistic CHSQ( 2)= 1.1004[.577]
******************************************************************************
```

Appendix 6 Section A

VAR(2)

```
INFO CRITERIA
OPTIMAL ENDOGENOUS LAGS FROM INFORMATION CRITERIA
endogenous variables: STDMER70_log_d1 PPP70_log_d1
exogenous variables: PRDRATIO
exogenous lags (fixed): 0
deterministic variables: dtbprdrimp dter70imp dtppp70imp CONST TREND
sample range: [1955, 1988], T = 34
optimal number of lags (searched up to 4 lags of levels):
Akaike Info Criterion: 1
Final Prediction Error: 1
Hannan-Quinn Criterion: 1
Schwarz Criterion: 1
```

VAR(1)

```
OPTIMAL ENDOGENOUS LAGS FROM INFORMATION CRITERIA
endogenous variables: STDMER70_log_d1 PPP70_log_d1
exogenous variables: PRDRATIO
exogenous lags (fixed): 0
deterministic variables: dtbprdrimp dter70imp dtppp70imp CONST TREND
sample range: [1955, 1988], T = 34
optimal number of lags (searched up to 4 lags of levels):
Akaike Info Criterion: 1
Final Prediction Error: 1
Hannan-Quinn Criterion: 1
Schwarz Criterion: 1
```

Appendix 7 Section A

Cointegration with no intercepts or trends in the VAR

```
Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix
******************************************************************************
37 observations from 1952 to 1988. Order of VAR = 1.
List of variables included in the cointegrating vector:
DLER70 DLPPP70
List of I(0) variables included in the VAR:
DTBPPP70 DTBPRDR DTBER70 DLPRDR
List of eigenvalues in descending order:
.32257 .076402
******************************************************************************
Null Alternative Statistic 95% Critical Value 90% Critical Value
r = 0 r = 1 14.4097 > 11.0300 9.2800
r<= 1 r = 2 2.9407 4.1600 3.0400
******************************************************************************
Use the above table to determine r (the number of cointegrating vectors).
Cointegration with no intercepts or trends in the VAR
Cointegration LR Test Based on Trace of the Stochastic Matrix
******************************************************************************
37 observations from 1952 to 1988. Order of VAR = 1.
List of variables included in the cointegrating vector:
DLER70 DLPPP70
List of I(0) variables included in the VAR:
DTBPPP70 DTBPRDR DTBER70 DLPRDR
List of eigenvalues in descending order:
.32257 .076402
******************************************************************************
Null Alternative Statistic 95% Critical Value 90% Critical Value
r = 0 r>= 1 17.3504 > 12.3600 10.2500
r<= 1 r = 2 2.9407 < 4.1600 3.0400
******************************************************************************
Use the above table to determine r (the number of cointegrating vectors).
Cointegration with no intercepts or trends in the VAR
Choice of the Number of Cointegrating Relations Using Model Selection Criteria
******************************************************************************
37 observations from 1952 to 1988. Order of VAR = 1.
List of variables included in the cointegrating vector:
DLER70 DLPPP70
List of I(0) variables included in the VAR:
DTBPPP70 DTBPRDR DTBER70 DLPRDR
List of eigenvalues in descending order:
```

.32257 .076402
****
Rank Maximized LL AIC SBC HQC
r = 0 137.1695 129.1695 122.7258 126.8978
r = 1 144.3743 133.3743 124.5142 130.2507
r = 2 145.8446 133.8446 124.1791 130.4371
****
AIC = Akaike Information Criterion SBC = Schwarz Bayesian Criterion
HQC = Hannan-Quinn Criterion

PANTULA PRINCIPLE

Appendix 7 Section B

Cointegration with restricted intercepts and no trends in the VAR

Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix
****
37 observations from 1952 to 1988. Order of VAR = 1.
List of variables included in the cointegrating vector:
DLER70 DLPPP70 Intercept
List of I(0) variables included in the VAR:
DTBPPP70 DTBPRDR DTBER70 DLPRDR
List of eigenvalues in descending order:
.34900 .091667 .0000
****
Null Alternative Statistic 95% Critical Value 90% Critical Value
r = 0 r = 1 15.8820 > 15.8700 13.8100
r<= 1 r = 2 3.5573 < 9.1600 7.5300
****
Use the above table to determine r (the number of cointegrating vectors).
Cointegration with restricted intercepts and no trends in the VAR
Cointegration LR Test Based on Trace of the Stochastic Matrix
****
37 observations from 1952 to 1988. Order of VAR = 1.
List of variables included in the cointegrating vector:
DLER70 DLPPP70 Intercept
List of I(0) variables included in the VAR:
DTBPPP70 DTBPRDR DTBER70 DLPRDR
List of eigenvalues in descending order:
.34900 .091667 .0000
****
Null Alternative Statistic 95% Critical Value 90% Critical Value
r = 0 r>= 1 19.4393 20.1800 17.8800
r<= 1 r = 2 3.5573 < 9.1600 7.5300
****
Use the above table to determine r (the number of cointegrating vectors).
Cointegration with restricted intercepts and no trends in the VAR
Choice of the Number of Cointegrating Relations Using Model Selection Criteria
****
37 observations from 1952 to 1988. Order of VAR = 1.
List of variables included in the cointegrating vector:
DLER70 DLPPP70 Intercept
List of I(0) variables included in the VAR:
DTBPPP70 DTBPRDR DTBER70 DLPRDR
List of eigenvalues in descending order:
.34900 .091667 .0000
****
Rank Maximized LL AIC SBC HQC
r = 0 137.1695 129.1695 122.7258 126.8978
r = 1 145.1104 133.1104 123.4449 129.7029
r = 2 146.8891 132.8891 121.6127 128.9136
****
AIC = Akaike Information Criterion SBC = Schwarz Bayesian Criterion
HQC = Hannan-Quinn Criterion

Appendix 7 Section C

Cointegration with unrestricted intercepts and no trends in the VAR

Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix
****
37 observations from 1952 to 1988. Order of VAR = 1.
List of variables included in the cointegrating vector:
DLER70 DLPPP70
List of I(0) variables included in the VAR:

```
DTBPPP70 DTBPRDR DTBER70 DLPRDR
List of eigenvalues in descending order:
.34175 .083773
*******************************************************************************
Null Alternative Statistic 95% Critical Value 90% Critical Value
r = 0 r = 1 15.4724 > 14.8800 12.9800
r<= 1 r = 2 3.2372 8.0700 6.5000
*******************************************************************************
Use the above table to determine r (the number of cointegrating vectors).
Cointegration with unrestricted intercepts and no trends in the VAR
Cointegration LR Test Based on Trace of the Stochastic Matrix
*******************************************************************************
37 observations from 1952 to 1988. Order of VAR = 1.
List of variables included in the cointegrating vector:
DLER70 DLPPP70
List of I(0) variables included in the VAR:
DTBPPP70 DTBPRDR DTBER70 DLPRDR
List of eigenvalues in descending order:
.34175 .083773
*******************************************************************************
Null Alternative Statistic 95% Critical Value 90% Critical Value
r = 0 r>= 1 18.7095 > 17.8600 15.7500
r<= 1 r = 2 3.2372 8.0700 6.5000
*******************************************************************************
Use the above table to determine r (the number of cointegrating vectors).
Cointegration with unrestricted intercepts and no trends in the VAR
Choice of the Number of Cointegrating Relations Using Model Selection Criteria
*******************************************************************************
37 observations from 1952 to 1988. Order of VAR = 1.
List of variables included in the cointegrating vector:
DLER70 DLPPP70
List of I(0) variables included in the VAR:
DTBPPP70 DTBPRDR DTBER70 DLPRDR
List of eigenvalues in descending order:
.34175 .083773
*******************************************************************************
Rank Maximized LL AIC SBC HQC
r = 0 137.5343 127.5343 119.4797 124.6947
r = 1 145.2705 132.2705 121.7996 128.5790
r = 2 146.8891 132.8891 121.6127 128.9136
*******************************************************************************
AIC = Akaike Information Criterion SBC = Schwarz Bayesian Criterion
HQC = Hannan-Quinn Criterion
```

Appendix 7 Section D

Cointegration with unrestricted intercepts and restricted trends in the VAR

```
Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix
*******************************************************************************
37 observations from 1952 to 1988. Order of VAR = 1.
List of variables included in the cointegrating vector:
DLER70 DLPPP70 Trend
List of I(0) variables included in the VAR:
DTBPPP70 DTBPRDR DTBER70 DLPRDR
List of eigenvalues in descending order:
.36563 .19376 0.00
*******************************************************************************
Null Alternative Statistic 95% Critical Value 90% Critical Value
r = 0 r = 1 16.8393 < 19.2200 17.1800
r<= 1 r = 2 7.9687 < 12.3900 10.5500
*******************************************************************************
Use the above table to determine r (the number of cointegrating vectors).
Cointegration with unrestricted intercepts and restricted trends in the VAR
Cointegration LR Test Based on Trace of the Stochastic Matrix
*******************************************************************************
37 observations from 1952 to 1988. Order of VAR = 1.
List of variables included in the cointegrating vector:
DLER70 DLPPP70 Trend
List of I(0) variables included in the VAR:
DTBPPP70 DTBPRDR DTBER70 DLPRDR
List of eigenvalues in descending order:
.36563 .19376 0.00
*******************************************************************************
Null Alternative Statistic 95% Critical Value 90% Critical Value
```

```
r = 0 r>= 1 24.8080 < 25.7700 23.0800
r<= 1 r = 2 7.9687 12.3900 10.5500
******************************************************************************
Use the above table to determine r (the number of cointegrating vectors).
Cointegration with unrestricted intercepts and restricted trends in the VAR
Choice of the Number of Cointegrating Relations Using Model Selection Criteria
******************************************************************************
37 observations from 1952 to 1988. Order of VAR = 1.
List of variables included in the cointegrating vector:
DLER70 DLPPP70 Trend
List of I(0) variables included in the VAR:
DTBPPP70 DTBPRDR DTBER70 DLPRDR
List of eigenvalues in descending order:
.36563 .19376 0.00
******************************************************************************
Rank Maximized LL AIC SBC HQC
r = 0 137.5343 127.5343 119.4797 124.6947
r = 1 145.9540 131.9540 120.6776 127.9785
r = 2 149.9383 133.9383 121.0510 129.3950
******************************************************************************
AIC = Akaike Information Criterion SBC = Schwarz Bayesian Criterion
HQC = Hannan-Quinn Criterion
```

Appendix 7 Section E

Cointegration with unrestricted intercepts and unrestricted trends in the VAR

```
Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix
******************************************************************************
37 observations from 1952 to 1988. Order of VAR = 1.
List of variables included in the cointegrating vector:
DLER70 DLPPP70
List of I(0) variables included in the VAR:
DTBPPP70 DTBPRDR DTBER70 DLPRDR
List of eigenvalues in descending order:
.30087 .19007
******************************************************************************
Null Alternative Statistic 95% Critical Value 90% Critical Value
r = 0 r = 1 13.2431 < 18.3300 16.2800
r<= 1 r = 2 7.7999 < 11.5400 9.7500
******************************************************************************
Use the above table to determine r (the number of cointegrating vectors).
Cointegration with unrestricted intercepts and unrestricted trends in the VAR
Cointegration LR Test Based on Trace of the Stochastic Matrix
******************************************************************************
37 observations from 1952 to 1988. Order of VAR = 1.
List of variables included in the cointegrating vector:
DLER70 DLPPP70
List of I(0) variables included in the VAR:
DTBPPP70 DTBPRDR DTBER70 DLPRDR
List of eigenvalues in descending order:
.30087 .19007
******************************************************************************
Null Alternative Statistic 95% Critical Value 90% Critical Value
r = 0 r>= 1 21.0430 23.8300 21.2300
r<= 1 r = 2 7.7999 < 11.5400 9.7500
******************************************************************************
Use the above table to determine r (the number of cointegrating vectors).
Cointegration with unrestricted intercepts and unrestricted trends in the VAR
Choice of the Number of Cointegrating Relations Using Model Selection Criteria
******************************************************************************
37 observations from 1952 to 1988. Order of VAR = 1.
List of variables included in the cointegrating vector:
DLER70 DLPPP70
List of I(0) variables included in the VAR:
DTBPPP70 DTBPRDR DTBER70 DLPRDR
List of eigenvalues in descending order:
.30087 .19007
******************************************************************************
Rank Maximized LL AIC SBC HQC
r = 0 139.4169 127.4169 117.7513 124.0093
r = 1 146.0384 131.0384 118.9565 126.7789
r = 2 149.9383 133.9383 121.0510 129.3950
******************************************************************************
AIC = Akaike Information Criterion SBC = Schwarz Bayesian Criterion
```

```
HQC = Hannan-Quinn Criterion
```

Appendix 7 Section F

```
*** Mon, 21 Apr 2008 22:26:23 ***
Johansen Trace Test for: STDMER70_log_d1 PPP70_log_d1
unrestricted dummies: dtber70imp dtbppp70imp dtbprdrimp
restricted dummies:
sample range: [1954, 1988], T = 35
included lags (levels): 1
dimension of the process: 2
intercept included
response surface computed:
-----------------------------------------------
r0 LR pval 90% 95% 99%
-----------------------------------------------
0 14.82 0.2420 17.98 20.16 24.69
1 2.31 0.7161 7.60 9.14 12.53
OPTIMAL ENDOGENOUS LAGS FROM INFORMATION CRITERIA
sample range: [1954, 1988], T = 35
optimal number of lags (searched up to 1 lags of levels):
Akaike Info Criterion: 1
Final Prediction Error: 1
Hannan-Quinn Criterion: 1
Schwarz Criterion: 1
```

Appendix 7 Section H
VAR(1)

```
*** Mon, 21 Apr 2008 23:59:47 ***
Johansen Trace Test for: STDMER70_log_d1 PPP70_log_d1
unrestricted dummies: dtber70imp dtbppp70imp dtbprdrimp
restricted dummies:
sample range: [1954, 1988], T = 35
included lags (levels): 1
dimension of the process: 2
trend and intercept included
response surface computed:
-----------------------------------------------
r0 LR pval 90% 95% 99%
-----------------------------------------------
0 16.82 0.4369 23.32 25.73 30.67
1 3.69 0.7817 10.68 12.45 16.22
OPTIMAL ENDOGENOUS LAGS FROM INFORMATION CRITERIA
sample range: [1954, 1988], T = 35
optimal number of lags (searched up to 1 lags of levels):
Akaike Info Criterion: 1
Final Prediction Error: 1
Hannan-Quinn Criterion: 1
Schwarz Criterion: 1
```

Appendix 7 Sector I
VAR(2)

```
*** Tue, 22 Apr 2008 00:31:08 ***
Johansen Trace Test for: STDMER70_log_d1 PPP70_log_d1
unrestricted dummies: dtber70imp dtbppp70imp dtbprdrimp
restricted dummies:
sample range: [1955, 1988], T = 34
included lags (levels): 2
dimension of the process: 2
trend and intercept included
response surface computed:
-----------------------------------------------
r0 LR pval 90% 95% 99%
-----------------------------------------------
0 19.75 0.2432 23.32 25.73 30.67
1 3.48 0.8094 10.68 12.45 16.22
OPTIMAL ENDOGENOUS LAGS FROM INFORMATION CRITERIA
sample range: [1957, 1988], T = 32
optimal number of lags (searched up to 4 lags of levels):
Akaike Info Criterion: 3
Final Prediction Error: 1
Hannan-Quinn Criterion: 1
```

Schwarz Criterion: 1

Appendix 7 Sector J

```
ML estimates subject to exactly identifying restriction(s)
Estimates of Restricted Cointegrating Relations (SE's in Brackets)
Converged after 2 iterations
Cointegration with restricted intercepts and no trends in the VAR
*******************************************************************************
37 observations from 1952 to 1988. Order of VAR = 1, chosen r =1.
List of variables included in the cointegrating vector:
DLER70 DLPPP70 Intercept
List of I(0) variables included in the VAR:
DTBER70 DTBPPP70 DTBPRDR LPRDR1
*******************************************************************************
List of imposed restriction(s) on cointegrating vectors:
A1=1;
*******************************************************************************
Vector 1
DLER70 1.0000
( *NONE*)
DLPPP70 -.45150
( .40408)
Intercept .36609
( .29052)
*******************************************************************************
LL subject to exactly identifying restrictions= 143.1769
```

Appendix 7 Sector K

```
VEC REPRESENTATION
endogenous variables: STDMER70_log_d1 PPP70_log_d1
exogenous variables: PRDRATIO_log_d1
deterministic variables: dtber70imp dtbppp70imp dtbprdrimp CONST TREND
endogenous lags (diffs): 1
exogenous lags: 0
sample range: [1953, 1988], T = 36
estimation procedure: One stage. S2S approach
Lagged endogenous term:
=======================
d(STDMER70_log_d1) d(PPP70_log_d1)
------------------------------------------------------------
d(STDMER70_log_d1)(t-1)| 0.295 -0.038
| (0.206) (0.065)
| {0.152} {0.558}
| [1.433] [-0.586]
d(PPP70_log_d1) (t-1)| 0.234 -0.037
| (0.429) (0.136)
| {0.585} {0.786}
| [0.546] [-0.271]
------------------------------------------------------------
Deterministic term:
===================
d(STDMER70_log_d1) d(PPP70_log_d1)
--------------------------------------------
CONST | -0.011 -0.002
| (0.021) (0.007)
| {0.586} {0.765}
| [-0.544] [-0.299]
TREND(t)| 0.000 0.000
| (0.001) (0.000)
| {0.722} {0.473}
| [-0.356] [-0.718]
--------------------------------------------
Loading coefficients:
=====================
d(STDMER70_log_d1) d(PPP70_log_d1)
--------------------------------------------
ec1(t-1)| -0.681 0.167
| (0.247) (0.079)
| {0.006} {0.033}
| [-2.758] [2.129]
--------------------------------------------
```

```
Estimated cointegration relation(s):
====================================
ec1(t-1)
------------------------------
STDMER70_log_d1(t-1)| 1.000
| (0.000)
| {0.000}
| [0.000]
PPP70_log_d1 (t-1)| -0.983
| (0.357)
| {0.006}
| [-2.754]
dtber70imp(t-1) | -0.060
| (0.072)
| {0.404}
| [-0.835]
dtbppp70imp(t-1) | -0.116
| (0.075)
| {0.121}
| [-1.549]
dtbprdrimp(t-1) | 0.073
| (0.076)
| {0.336}
| [0.962]
------------------------------
VAR REPRESENTATION
modulus of the eigenvalues of the reverse characteristic polynomial:
|z| = ( 2.1172 2.1172 1.0000 116.5414 )
Legend:
=======
Equation 1 Equation 2 ...
------------------------------------------
Variable 1 | Coefficient ...
| (Std. Dev.)
| {p - Value}
| [t - Value]
Variable 2 | ...
...
------------------------------------------
Lagged endogenous term:
=======================
STDMER70_log_d1 PPP70_log_d1
---------------------------------------------------
STDMER70_log_d1(t-1)| 0.614 0.129
| (0.000) (0.000)
| {0.000} {0.000}
| [0.000] [0.000]


PPP70_log_d1 (t-1)| 0.904 0.799
| (0.000) (0.000)
| {0.000} {0.000}
| [0.000] [0.000]
STDMER70_log_d1(t-2)| -0.295 0.038
| (0.000) (0.000)
| {0.000} {0.000}
| [0.000] [0.000]
PPP70_log_d1 (t-2)| -0.234 0.037
| (0.000) (0.000)
| {0.000} {0.000}
| [0.000] [0.000]
---------------------------------------------------
Deterministic term:
===================
STDMER70_log_d1 PPP70_log_d1
--------------------------------------------------
CONST (t)| -0.011 -0.002
| (0.000) (0.000)
| {0.000} {0.000}
| [0.000] [0.000]
TREND (t)| 0.000 0.000
| (0.000) (0.000)
| {0.000} {0.000}
| [0.000] [0.000]
```

```
dtber70imp(t-1) (t)| 0.041 -0.010
| (0.000) (0.000)
| {0.000} {0.000}
| [0.000] [0.000]
dtbppp70imp(t-1)(t)| 0.079 -0.019
| (0.000) (0.000)
| {0.000} {0.000}
| [0.000] [0.000]
dtbprdrimp(t-1) (t)| -0.049 0.012
| (0.000) (0.000)
| {0.000} {0.000}
| [0.000] [0.000]
```

Appendix 8 Section A

Maximum likelihood ratio for estimation subject to over-identifying restrictions

```
ML estimates subject to over identifying restriction(s)
Estimates of Restricted Cointegrating Relations (SE's in Brackets)
Converged after 2 iterations
Cointegration with restricted intercepts and no trends in the VAR
******************************************************************************
37 observations from 1952 to 1988. Order of VAR = 1, chosen r =1.
List of variables included in the cointegrating vector:
DLER70 DLPPP70 Intercept
List of I(0) variables included in the VAR:
DLPRDR DTBER70 DTBPPP70 DTBPRDR
******************************************************************************
List of imposed restriction(s) on cointegrating vectors:
A1=1; A2= -1; A3=0;
******************************************************************************
Vector 1
DLER70 1.0000
DLPPP70 -1.0000
Intercept 0.00
******************************************************************************
LR Test of Restrictions CHSQ( 2)= 1.5577[.459]
DF=Total no of restrictions(3) - no of just-identifying restrictions(1)
LL subject to exactly identifying restrictions= 145.1104
LL subject to over-identifying restrictions= 144.3316
******************************************************************************
```

Appendix 8 Section B

WALD test for the restrictions imposed on the three variables (Johansene ML estimator)

```
*** Tue, 22 Apr 2008 17:34:27 ***
WALD TEST FOR BETA RESTRICTIONS (using Johansen ML estimator)
R*vec(beta'(K-r))=r; displaying R and r:
-1.0000 1.0000 0.0000 1.0000
test statistic: 1.2157
p-value: 0.2702
degrees of freedom: 1.0000
```

Appendix Research Methods in Economics II

Appendix 8 Section C

Co-integration Vector

One overidentifying resdtriction

```
*** Tue, 22 Apr 2008 17:30:33 ***
VEC REPRESENTATION
endogenous variables: STDMER70_log_d1 PPP70_log_d1
exogenous variables: PRDRATIO_log_d1
deterministic variables: dtber70imp dtbppp70imp dtbprdrimp CONST TREND
endogenous lags (diffs): 1
exogenous lags: 0
sample range: [1953, 1988], T = 36
estimation procedure: One stage. S2S approach
Lagged endogenous term:
======================
d(STDMER70_log_d1) d(PPP70_log_d1)
------------------------------------------------------------
d(STDMER70_log_d1)(t-1)| 0.342 -0.135
| (0.181) (0.067)
```

```
| {0.058} {0.043}
| [1.892] [-2.026]
d(PPP70_log_d1) (t-1)| 0.219 0.066
| (0.361) (0.133)
| {0.544} {0.621}
| [0.607] [0.494]
------------------------------------------------------------
Deterministic term:
===================
d(STDMER70_log_d1) d(PPP70_log_d1)
---------------------------------------------------
dtbppp70imp(t)| 0.018 -0.052
| (0.066) (0.024)
| {0.783} {0.034}
| [0.275] [-2.120]
dtbprdrimp (t)| 0.131 0.036
| (0.070) (0.026)
| {0.061} {0.163}
| [1.875] [1.395]
TREND (t)| -0.001 0.000
| (0.001) (0.000)
| {0.238} {0.305}
| [-1.179] [-1.026]
---------------------------------------------------
Loading coefficients:
=====================
d(STDMER70_log_d1) d(PPP70_log_d1)
----------------------------------------------
ec1(t-1)| -0.940 0.127


| (0.244) (0.090)
| {0.000} {0.159}
| [-3.853] [1.407]
----------------------------------------------
Estimated cointegration relation(s):
====================================
ec1(t-1)
------------------------------
STDMER70_log_d1(t-1)| 1.000
| (0.000)
| {0.000}
| [0.000]
PPP70_log_d1 (t-1)| -1.049
| (0.000)
| {0.000}
| [0.000]
dtber70imp(t-1) | -0.049
| (0.058)
| {0.397}
| [-0.848]
CONST | -0.003
| (0.020)
| {0.878}
| [-0.154]
------------------------------
VAR REPRESENTATION
modulus of the eigenvalues of the reverse characteristic polynomial:
|z| = ( 1.5219 1.5219 1.0000 8.2882 )
Legend:
=======
Equation 1 Equation 2 ...
------------------------------------------
Variable 1 | Coefficient ...
| (Std. Dev.)
| {p - Value}
| [t - Value]
Variable 2 | ...
...
------------------------------------------
Lagged endogenous term:
=======================
STDMER70_log_d1 PPP70_log_d1
---------------------------------------------------
STDMER70_log_d1(t-1)| 0.402 -0.008
| (0.000) (0.000)
```

```
| {0.000} {0.000}


| [0.000] [0.000]
PPP70_log_d1 (t-1)| 1.205 0.933
| (0.000) (0.000)
| {0.000} {0.000}
| [0.000] [0.000]
STDMER70_log_d1(t-2)| -0.342 0.135
| (0.000) (0.000)
| {0.000} {0.000}
| [0.000] [0.000]
PPP70_log_d1 (t-2)| -0.219 -0.066
| (0.000) (0.000)
| {0.000} {0.000}
| [0.000] [0.000]
---------------------------------------------------
Deterministic term:
===================
STDMER70_log_d1 PPP70_log_d1
-------------------------------------------------
dtbppp70imp (t)| 0.018 -0.052
| (0.000) (0.000)
| {0.000} {0.000}
| [0.000] [0.000]
dtbprdrimp (t)| 0.131 0.036
| (0.000) (0.000)
| {0.000} {0.000}
| [0.000] [0.000]
TREND (t)| -0.001 0.000
| (0.000) (0.000)
| {0.000} {0.000}
| [0.000] [0.000]
dtber70imp(t-1)(t)| 0.046 -0.006
| (0.000) (0.000)
| {0.000} {0.000}
| [0.000] [0.000]
CONST (t)| 0.003 0.000
| (0.000) (0.000)
| {0.000} {0.000}
| [0.000] [0.000]
-------------------------------------------------
```

Appendix 8 Section D
Just identifying restrictions
Model with constant terms only

```
*** Wed, 23 Apr 2008 00:07:30 ***
VECM MODEL STATISTICS
sample range: [1953, 1988], T = 36
Log Likelihood: 1.431364e+02
Determinant (Cov): 1.206514e-06
Covariance: 2.993200e-03 6.358193e-05
6.358193e-05 4.044356e-04
Correlation: 1.000000e+00 5.778846e-02
5.778846e-02 1.000000e+00
```

Models with constant and trend terms

```
*** Wed, 23 Apr 2008 00:09:55 ***
VECM MODEL STATISTICS
sample range: [1953, 1988], T = 36
Log Likelihood: 1.442889e+02
Determinant (Cov): 1.131681e-06
Covariance: 2.881940e-03 2.783323e-05
2.783323e-05 3.929493e-04
Correlation: 1.000000e+00 2.615489e-02
2.615489e-02 1.000000e+00
```

Appendix 8 Section E
VEC Restrictions with Just identifying restrictions on Beta Matrix

```
PORTMANTEAU TEST (H0:Rh=(r1,...,rh)=0)
tested order: 1
test statistic: 0.8419
p-value: NaN
adjusted test statistic: 0.8660
p-value: NaN
degrees of freedom: NaN
*** Wed, 23 Apr 2008 00:15:14 ***
LM-TYPE TEST FOR AUTOCORRELATION with 1 lags
LM statistic: 5.4166
p-value: 0.2472
df: 4.0000

TESTS FOR NONNORMALITY
Reference: Doornik & Hansen (1994)
joint test statistic: 5.6327
p-value: 0.2283
degrees of freedom: 4.0000
skewness only: 3.3396
p-value: 0.1883
kurtosis only: 2.2931
p-value: 0.3177
Reference: Lütkepohl (1993), Introduction to Multiple Time Series Analysis, 2ed, p. 153
joint test statistic: 6.0319
p-value: 0.1968
degrees of freedom: 4.0000
skewness only: 3.9281
p-value: 0.1403
kurtosis only: 2.1038
p-value: 0.3493

JARQUE-BERA TEST
variable teststat p-Value(Chi^2) skewness kurtosis
u1 4.9502 0.0842 -0.7879 3.9038
u2 0.9342 0.6268 -0.0353 3.7860
*** Wed, 23 Apr 2008 00:15:14 ***
MULTIVARIATE ARCH-LM TEST with 1 lags
VARCHLM test statistic: 11.1140
p-value(chi^2): 0.2680
degrees of freedom: 9.0000
```

Appendix 8 Section F
VEC model with restrictions on Beta matrix

```
PORTMANTEAU TEST (H0:Rh=(r1,...,rh)=0)
tested order: 1
test statistic: 6.5111
p-value: NaN
adjusted test statistic: 6.6971
p-value: NaN
degrees of freedom: NaN
*** Wed, 23 Apr 2008 00:32:15 ***
LM-TYPE TEST FOR AUTOCORRELATION with 1 lags
LM statistic: 26.6042
p-value: 0.0000
df: 4.0000
*** Wed, 23 Apr 2008 00:32:15 ***
TESTS FOR NONNORMALITY
Reference: Doornik & Hansen (1994)
joint test statistic: 12.9544
p-value: 0.0115
degrees of freedom: 4.0000
skewness only: 6.8676
p-value: 0.0323
kurtosis only: 6.0868
p-value: 0.0477
Reference: Lütkepohl (1993), Introduction to Multiple Time Series Analysis, 2ed, p. 153
joint test statistic: 11.4066
p-value: 0.0224
degrees of freedom: 4.0000
skewness only: 5.6752
p-value: 0.0586
```

```
kurtosis only: 5.7313
p-value: 0.0569
*** Wed, 23 Apr 2008 00:32:15 ***
JARQUE-BERA TEST
variable teststat p-Value(Chi^2) skewness kurtosis
u1 4.9760 0.0831 -0.9087 2.8797
u2 17.4024 0.0002 1.2584 5.2951
*** Wed, 23 Apr 2008 00:32:15 ***
MULTIVARIATE ARCH-LM TEST with 1 lags
VARCHLM test statistic: 20.1991
p-value(chi^2): 0.0167
degrees of freedom: 9.0000
```

Appendix 8 Section G

Vector Error Correction Model

Just identifying Restrictions

```
*** Wed, 23 Apr 2008 01:03:46 ***
VEC REPRESENTATION
endogenous variables: STDMER70_log_d1 PPP70_log_d1
exogenous variables: PRDRATIO_log_d1
deterministic variables: dtber70imp dtbppp70imp dtbprdrimp CONST TREND
endogenous lags (diffs): 1
exogenous lags: 0
sample range: [1953, 1988], T = 36
estimation procedure: One stage. S2S approach
Lagged endogenous term:
=======================
d(STDMER70_log_d1) d(PPP70_log_d1)
------------------------------------------------------------
d(STDMER70_log_d1)(t-1)| 0.295 -0.038
| (0.206) (0.065)
| {0.152} {0.558}
| [1.433] [-0.586]
d(PPP70_log_d1) (t-1)| 0.234 -0.037
| (0.429) (0.136)
| {0.585} {0.786}
| [0.546] [-0.271]
------------------------------------------------------------
Deterministic term:
===================
d(STDMER70_log_d1) d(PPP70_log_d1)
----------------------------------------------
CONST | -0.011 -0.002
| (0.021) (0.007)
| {0.586} {0.765}
| [-0.544] [-0.299]
TREND(t)| 0.000 0.000
| (0.001) (0.000)
| {0.722} {0.473}
| [-0.356] [-0.718]
----------------------------------------------
Loading coefficients:
=====================
d(STDMER70_log_d1) d(PPP70_log_d1)
----------------------------------------------
ec1(t-1)| -0.681 0.167
| (0.247) (0.079)
| {0.006} {0.033}
| [-2.758] [2.129]
----------------------------------------------
```

```
Estimated cointegration relation(s):
====================================
ec1(t-1)
------------------------------
STDMER70_log_d1(t-1)| 1.000
| (0.000)
| {0.000}
| [0.000]
PPP70_log_d1 (t-1)| -0.983
| (0.357)
| {0.006}
| [-2.754]
dtber70imp(t-1) | -0.060
| (0.072)
| {0.404}
| [-0.835]
dtbppp70imp(t-1) | -0.116
| (0.075)
| {0.121}
| [-1.549]
dtbprdrimp(t-1) | 0.073
| (0.076)
| {0.336}
| [0.962]
------------------------------
VAR REPRESENTATION
modulus of the eigenvalues of the reverse characteristic polynomial:
|z| = ( 2.1172 2.1172 1.0000 116.5414 )
Legend:
=======
Equation 1 Equation 2 ...
------------------------------------------
Variable 1 | Coefficient ...
| (Std. Dev.)
| {p - Value}
| [t - Value]
Variable 2 | ...
...
------------------------------------------
Lagged endogenous term:
=======================
STDMER70_log_d1 PPP70_log_d1
---------------------------------------------------
STDMER70_log_d1(t-1)| 0.614 0.129
| (0.000) (0.000)
| {0.000} {0.000}


| [0.000] [0.000]
PPP70_log_d1 (t-1)| 0.904 0.799
| (0.000) (0.000)
| {0.000} {0.000}
| [0.000] [0.000]
STDMER70_log_d1(t-2)| -0.295 0.038
| (0.000) (0.000)
| {0.000} {0.000}
| [0.000] [0.000]
PPP70_log_d1 (t-2)| -0.234 0.037
| (0.000) (0.000)
| {0.000} {0.000}
| [0.000] [0.000]
---------------------------------------------------
Deterministic term:
===================
STDMER70_log_d1 PPP70_log_d1
--------------------------------------------------
CONST (t)| -0.011 -0.002
| (0.000) (0.000)
| {0.000} {0.000}
| [0.000] [0.000]
TREND (t)| 0.000 0.000
| (0.000) (0.000)
| {0.000} {0.000}
| [0.000] [0.000]
dtber70imp(t-1) (t)| 0.041 -0.010
| (0.000) (0.000)
```

```
| {0.000} {0.000}
| [0.000] [0.000]
dtbppp70imp(t-1)(t)| 0.079 -0.019
| (0.000) (0.000)
| {0.000} {0.000}
| [0.000] [0.000]
dtbprdrimp(t-1) (t)| -0.049 0.012
| (0.000) (0.000)
| {0.000} {0.000}
| [0.000] [0.000]
------------------------------------------------
```

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